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Probity in Business and Professional Dealings

STOCKHOLDERS should publicly repudiate a company official who amasses wealth by corrupt and unethical methods. This opinion was expressed at Washington recently by Judge Edwin B. Parker, chairman of the Board of Directors of the Chamber of Commerce of the United States, who maintained that unless business purges itself of those who flaunt the law and abuse their power the public will insist on the enforcement of legislative and governmental regulation that will seriously hamper industrial initiative and progress.

The recent conspicuous examples of prominent individuals becoming intoxicated with power and involved in transactions tainted with fraud and corruption, violating every principle of ethics and recognized business conduct, holding themselves above the law, are not peculiar to this day, Judge Parker maintained. The duty of business today is to purge itself of officials who betray a public trust, to put the ban of outlawry upon those who show a contempt for the public interest, for the government that affords protection to them and to their property, and for the institutions of justice. Organized business needs courage, and it should act promptly in its own interests and in the interests of the public. As an example of such action comes the news that Mr. John D. Rockefeller, Jr., has requested the resignation of Robert W. Stewart as chairman of the Standard Oil Company of Indiana.

It is true that group initiative must stamp out individual wrongdoing within the group. But with group loyalty to individual corruption the public is becoming blasé and skeptical as to the possibility of reform. One hears the remark on all sides, "You can't convict a million dollars," and each "verdict" by which the wealthy transgressor is acquitted of obvious misdemeanors confirms the logic of the conclusion. Let us hope that this malign influence may not take root and result in corrupt American business methods becoming notorious in foreign countries also. The front page of a leading daily recently screamed the announcement that "Americans Study $500,000,000 Argentina-Chile Canal Project," explaining that the proposed route would traverse the rich petroleum region of Chubut Province. Those with an acquaintance of South American affairs know that if money is available and if American engineering skill is to be utilized in that part of the world, a more urgent need is to secure regular and efficient railroad service over and through the Andes between Valparaiso and Buenos Aires, involving a reconstruction of the existing line. A half-billion dollar proposal that another project should be started smells in advance of the corruption that has recently disgraced United States business.

The mining industries have their black sheep in every country, but there is no concerted approval of wrongdoing, and no evidence in their ranks of a tendency toward what Judge Parker stigmatizes as "business atavism—that throwback to a day of unrestrained individualism." The attitude and privilege of our industrialists and professional men should be to see that the mining industries maintain a reputation for group decency in their dealings with the public, with the government and with the courts.

The Need for Increased Appropriations for Research

MORE MONEY should be appropriated by the government for technical research. Opposition to this proposal by the Director of the Budget would surely be overcome by Congress if that body understood the importance to industry of such investigation. True, the Director acts for the executive in wielding the budgetary axe, and Congress, in restoring an appropriation cut by him, might simply be inviting the Presidential veto. But Congress and not the President makes the laws and votes appropriations, and within its power is the right to override a veto. It should not permit research to be neglected simply because an official, ignorant of its merits, decides arbitrarily to eliminate from a bureau's budget the amount of money that would permit desirable investigations to be carried on.

Specifically, the U. S. Bureau of Mines should have a more liberal allowance for studying ways of beneficiating low-grade ores. Existence of large tonnages of such materials, unmarketable in their natural state, can be demonstrated. This is particularly true of manganese.

For research, the most pressing problems will naturally receive attention first. Among them are those that must be solved in the interest of war preparedness. An excellent example is the problem of making the United States self-sufficient with respect to manganese. It is easy to demonstrate that the country has only a small reserve of high-grade ferro ores. Independence, therefore, can presumably be attained only by beneficiating the low-grade ores, a field in which private research has already made progress. The beneficiation of manganese carbonate ores at Butte is already an accomplished fact. Another project is to be set on foot this summer on the Cuyuna Range of Minnesota, where a plant to treat siliceous low-manganese ores by leaching will be erected. If private research, handicapped by limited funds, can make such headway in the short space of a few years, what might not be accomplished by the government, with its facilities and resources, if it would assume the burden? Here government might properly concern itself with

business to the advantage of the latter. How much better it would be to aid in making the most of what the nation has, such as it is, instead of pursuing a course that tends to kill the spirit of enterprise in others by ignoring everything save adverse facts.

May it not be argued that research by the government might properly keep well in advance of the needs of industry? Carried to the extreme, such efforts would be comparable to research in pure science, in which the direct utility of the result sought is not a question of prime importance. Specifically once more, might not the government set itself to discover all reasonable ways of extracting or concentrating the manganese contained in the huge tonnages of manganiferous material too low in grade to be considered ore today, and leave the matter of cost to be dealt with by the future? The extraction processes thus devised might then be rated according to the costs that at the moment they respectively involve. Such research would be of inestimable value to the metallurgist and chemist of the not very distant future. Lack of an immediately visible profit would in most cases deter a private corporation from engaging in so thorough an investigation. The government, however, having no dividend to pay or interest charge to earn, could undertake it.

Looking ahead, without overly straining the imagination, one can picture the metallurgist of the future smiling at his predecessor of today, if the latter should desist in his efforts to produce a certain commodity because of the lack of "high-grade ore," when all about him in the earth's crust in varying quantity the desired substance existed. Intensive research of the kind suggested is entirely justified where a commodity as vitally important as manganese is concerned. But manganese is not the only mineral to which this line of reasoning may be applied.

Metallurgist Turned Professor Stresses Importance of Practical Work

NOT MANY MINING SCHOOLS in the world have an asset of such value as that possessed by the College of Mines and Engineering of the University of Arizona in the person of Dr. E. P. Mathewson, whose special course for those of some experience in mining and metallurgical work is attracting favorable attention. The plan was initiated in 1926, and the program comprises a month at the university, followed by a month of practical work at the mines, supplemented by lectures by company officials. It is evident that so intensive a course of study and observation will reduce the time necessary for a would-be engineer to grasp the fundamentals and differentiate the practices prevailing in his particular field of interest. With his class this year Dr. Mathewson has visited mines, smelters, and plants in Bisbee, Warren, Douglas, Cananea, Benson, Miami, Inspiration, and many other Southwest centers of technical and engineering activity.

The cost of the course has averaged about $850, tuition being free, the outlay involving cost of board and lodging, traveling expenses, and textbooks. One can imagine what an excellent time the class has had and how pleasant must have been the acquisition of knowledge thus. Daily personal contact with Dr. Mathewson, with opportunity to benefit from his world-wide experience as a metallurgist and an executive, would be an education in itself.

Russo-Asiatic Chairman Foresees Economic Reconstruction of Russia

THE CHAIRMAN of Russo-Asiatic Consolidated, Ltd., Mr. Leslie Urquhart, regretfully told his shareholders at the recent meeting in London that no progress has been made in the effort to persuade the Soviet government to make restitution for the seized Russian properties of the company; but his remark held promise in that, with the economic condition of Russia under Communist rule going from bad to worse, it was likely that action would have to be taken before long that would readmit and attract foreign capital.

It may be remembered that Russo-Asiatic was formed after the close of the war to consolidate the interests of companies holding several mines, smelters, refineries, and other properties in Russia and Siberia that had been confiscated by the Soviet in its anti-capital crusade in 1918. In 1922 an arrangement was drawn up whereby a modest cash payment was to be made by the Soviet government and the properties were to be returned to Russo-Asiatic as concessions. This, however, was not ratified by the Communist government, and no further progress has since been made. Meanwhile, Russo-Asiatic has turned its activities to other fields—to Mount Isa, in Australia, and to the Villemagne and St. Sebastien properties, in France. The company now has its Russian interests in the hands of the British government, with a claim for £56,000,000—a third of the entire British private claim against the Soviet. It is probable, however, that much less would be accepted, or that an arrangement similar to that planned in 1922 would be acceptable.

Mr. Urquhart spoke of the dire need of the Russian people. Instead of grain exports of twelve or fifteen million tons, as before the war—the chief support of the country in its external trade—exports are now but half a million tons, without enough left for domestic needs at that. Goods manufactured in Russia cost twice as much as imported goods. Russian money is not accepted from foreign holders, and the proceeds of an internal bond issue of £50,000,000 have been considered as revenue in the national budget, in order to hide the government's bankrupt position, according to Mr. Urquhart. These factors are bringing the rulers of the country, he says, to consider "a change in the policy of the Soviet government and a return to the economic system and honorable business customs which rule the life of the civilized world. The Soviet government knows that the prerequisite condition toward the re-establishment of its credit and of sound business relations with this country is to come to an honorable settlement with its creditors." Additional news of Russo-Asiatic development will be found in the London letter, issue of May 19.

The Soviet idea of government has not been a success, and a gradual return to the capitalistic system, already in progress, is inevitable. This is not to say that all the ideas of the Communist government have been bad or impracticable, or that the capitalistic system is the apotheosis of economic progress. Perhaps if all nations started from scratch, the Soviet idealists would have been considerably more successful. But when inexperienced leaders take an agricultural country like Russia, peopled largely with ignorant peasants, and try to swim counter to the economic flow of the rest of the world with which they must do business, failure is certain.

Russia has vast mining resources that cannot be devel-

oped without foreign capital, British or American. These countries stand together in their refusal to accept the present Russian régime, but as soon as it is evident that pre-war holdings of foreign interests are to be recognized, and some assurance is given that dealings in the future will be on an honorable basis, credit will be forthcoming and the terms of immediate payment will not be arduous.

The nations of the world are in no mood to secure the economic readjustment of Russia by force of arms; the effort must come from within Russia itself, and a real change of heart must be apparent. At first, foreign companies will be likely to consider the risk and will try to drive a hard bargain; but continued fair dealing will gradually inspire that confidence which will bring the demanded rate of return on foreign investment in Russia to that secured in other stable countries of the world.

Dust as a Causative of Pulmonary Disease

THAT dust in mines and metallurgical plants has ill effects on the health and physical efficiency of workmen is generally acknowledged. However, it appears that the exact action of dust in promoting tuberculosis and associated diseases may have been misunderstood. Mining men and metallurgists in close touch with operating conditions have been inclined to accept the conclusion that the harmful action of the dust in the lungs is due to the angularity or sharpness of the cleavage faces of the particles and their abrasive action on the lung tissue.

Dr. A. E. Russell, assistant surgeon of the United States Public Health Service, speaking before a recent meeting of the Chemical Section of the National Safety Council, explained the conclusion drawn from a research conducted by his department, which indicates that the harmful effect of dust is the result of a physico-chemical action rather than of mechanical attrition. Lime dust is not harmful, as such, nor are silicate mineral particles, or chemical compounds of silicon with other elements, in their combined state. According to this hypothesis, the quantity of free silica in the dust determines the degree of hazard, the particles being occluded in the lung tissue with the formation of a colloidal silica, a virulent cell poison.

The presence of free silica in many dusty operations where the product cannot be classified in the quartz or free-silica class has been proved by chemical analysis. Falling within this group are lime quarries, anthracite mines, and plants manufacturing abrasives. The operator of an electric locomotive in a Pennsylvania coal mine contracted tubercular silicosis and died within a short time after the symptoms were first noticed. The resulting investigation revealed that the sand used on the rails for providing traction under the locomotive wheels had become finely pulverized, and in this condition remained suspended in the air after each passage of the train through the haulageway, resulting in the introduction of a large quantity of free silica into the lungs of the operator.

The most important phase of the dust problem in the mining industry at present is the search for methods of preventing the formation of dust, or of eliminating it as quickly as possible after it has been formed. However, medical research is essential, even though it does no more than establish, definitely, the exact action of dust in promoting pulmonary disease. To most mine and plant operators the conclusions drawn from the United States Public Health Service's study present a hitherto unconsidered angle of the problem, deserving of the thoughtful consideration of engineers and executives.

Rehabilitation of Europe's Metal Industries

NON-FERROUS METALS, like most other commodities produced from different localities in each of the continents and used by industry in all progressive countries, must be sold in a world-wide market. The relation between supply and demand must be viewed on a world basis. Lead is the only major metal that is affected by the American tariff, the reason being that mines in the United States produce a little less than is consumed by domestic users. However, if the foreign production so far exceeds foreign requirements as to lower the price in London, the weakness invariably is reflected in the market price in the United States. A differential exists between the two markets, but it is comparatively constant, and the foreign and domestic prices fluctuate in close synchronism.

Accordingly, industrial activity in the United States does not necessarily spell high prices for metals and consequent prosperity for mining companies. The position necessarily must be considered from a world standpoint. In 1926, record-breaking consumption of metals in the United States was the main support of the world markets; but in 1927 domestic industry was not so active. A measurable decline in the consumption of each of the major metals—copper, lead, zinc, and tin—materialized. It is true that prices, generally, declined. But how much more serious this tendency might have been, had it not been for Europe, is not pleasant to contemplate. If Great Britain and the Continental countries—France and Italy excepted—had used no more metal than they did during 1926, many mines probably would have been shut down before now. The accompanying table indicates at a glance the increase, ranging from 8 per cent for zinc to 18 per cent for copper, in the aggregate takings of Europe during the last two years.

Monthly Average Net Imports of Metals in European Countries

	1926	1927	Increase, per Cent
Copper, tons	39,670	46,875	18
Lead, tons	37,758	43,079	14
Zinc, tons	24,411	26,416	8
Tin, tons	2,922	3,321	14

Incidentally, European countries used ten million tons more steel in 1927 than in 1926; whereas in the United States a decline of four million tons was recorded. Presumably these data, to some extent, reflect inroads upon sales of finished products by American manufacturers in foreign countries. But, even so, the rehabilitation of the metal industries of Europe must be viewed with great satisfaction by the United States, and particularly by the American mining industry. By and large, the United States uses more than half of the metals produced in the world; but this leaves European countries, taken collectively, an important factor in the picture. A team pulls best when both members are working effectively.

How Prosperous Is The Metal-Mining Industry?

By A. B. PARSONS
Associate Editor

RUDYARD KIPLING, according to a story that is, at least, as authentic as the average of its type, on the occasion of a call on Mark Twain, found the humorist sitting before an open encyclopedia. Kipling expressed surprise that Twain should be thus engaged, whereupon the latter explained that once he got the facts on any subject, he could distort them to suit his particular purpose.

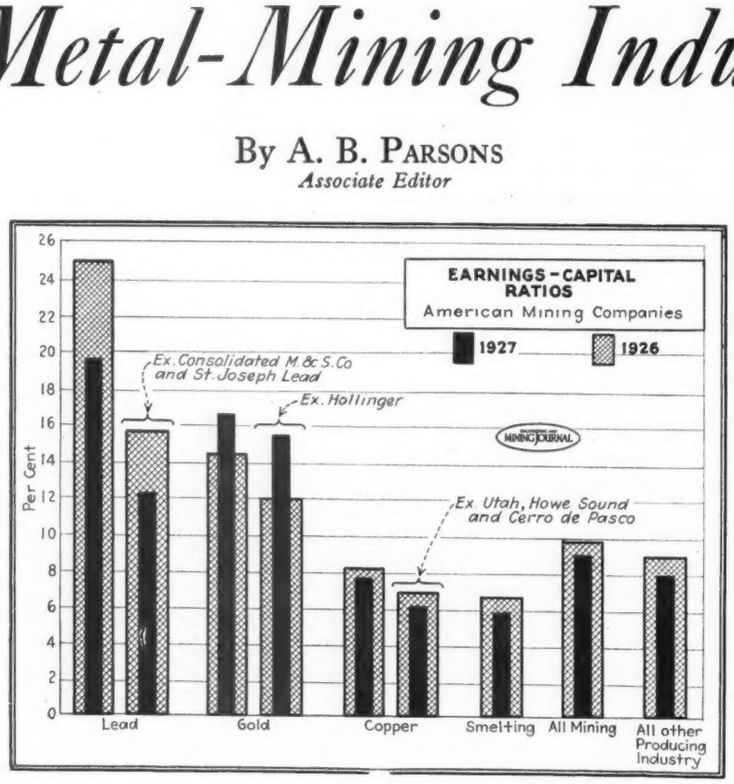


Chart I—Showing Comparative Earnings in 1926 and 1927

Statistical data are notorious for their susceptibility to various ways of selection, interpretation, and compilation so as to prove, apparently, almost anything within reason. If one's purpose were to convince legislators that taxes were too high or restrictive laws too burdensome, it might be made to appear that the mining industry was far from prosperous. If, on the other hand, it were desired to attract capital, either to finance new projects or to push up prices of shares in the stock market, statistics could be marshalled that would make the mining industry as a whole look like a General Motors or, not to relegate mining to a back seat, a Consolidated Mining & Smelting Company of Canada. But having no "purpose" other than to set forth the position in its true light as nearly as possible, I can plead not guilty to any deliberate "distortion."

In the first place, it is clear that the talk of "profitless prosperity" in 1927 was exaggerated. The theory that industry was going through the motions of doing business without actually earning reasonable profits collapses to a large extent when the financial results of representative companies are compiled. True, net profits of industrial corporations declined about 8 per cent in 1927, compared with 1926; and the net earnings of railroads shrunk in somewhat larger proportion. On the other hand, farm profits presumably improved; public utilities, retail-merchandizing companies and other "non-producers," such as financial and insurance companies, did much better in 1927 than in 1926. It is significant that, if the heavy decline in earnings of oil companies be excluded from the calculation, aggregate net earnings of industrial corporations are approximately equal in the two years; and it is important to remember that 1926 was a year of record-breaking industrial activity and profits.

One point is that in 1927 prosperity was inclined to be "spotty," not only as between industries but as between companies within a given industry. Frequently a few big organizations thrived so exuberantly that the net result for the particular industry was excellent, even though a large number of smaller units realized slim profits, or reported a loss. To a certain extent this applies to the mining industry. Everything considered, however, it does not seem that the small shrinkage in profits of industrial companies justifies all of the pessimistic talk that has been circulating.

How prosperous is the metal-mining industry? Unfortunately there is no basis on which one can juggle the available data on earnings or dividends and finally reach a specific figure that says mining prosperity was 50 or 90 or 120 per cent of par. That cannot be done for one metal, much less for a group in which the degrees of prosperity manifestly differed widely. The best one can do is to make comparisons and judge the relative position. Two such comparisons are as follows:

(1) Generally speaking, 1926 was regarded as a very satisfactory year for non-ferrous metal mining. Assuming that this was so, it is possible to assemble data to show how mining in 1927 compared with mining in 1926.

(2) Authorities agree that the general level of industrial prosperity in the United States has been high. Consequently it is possible to draw a comparison between mining and other "producing" industries to ascertain the relative degree of prosperity as between mining and the others. There exists, of course, one vital difference between mining and virtually all other industries—namely, the fact that an orebody, the basis of *all value* in a mining

Table I—American Mining Companies—Production, Earnings and Dividends, 1926 and 1927

Figures, Except Ratios, are in Thousands

Company	1926 Invested Capital	1926 Production	1926 Gross Income	1926 Profit: Operating	1926 Profit: Net Before Depletion	1926 Dividends	1926 Bond Interest	1926 Earnings-Capital Ratio	1927 Invested Capital	1927 Production	1927 Gross Income	1927 Profit: Operating	1927 Profit: Net Before Depletion	1927 Dividends	1927 Bond Interest	1927 Earnings-Capital Ratio
Copper																
Calumet & Arizona (a)	41,372	46,441 C	8,328	1,939	1,524	1,785	.....	3.7	41,049	48,812 C	8,366	1,621	1,175	1,336	.....	2.9
Calumet & Hecla	63,107	104,295 C	14,741	4,911	3,019	3,006	.....	4.8	59,678	108,760 C	14,266	3,931	2,489	4,008	.....	4.2
Chile	153,577	215,286 C	30,375	18,234	(g) 13,894	10,978	2,239	9.1	154,494	235,000 C	31,279	18,050	(g) 13,448	11,023	2,363	8.8
Copper Range	(h) 6,000	23,526 C	4,433	499	(i) 90	394	.....	1.5	(h) 6,000	22,674 C	4,142	622	(i) 151	394	.....	2.5
Granby	35,119	53,925 C	8,718	2,380	886	.....	251	2.5	22,087	56,111 C	8,411	1,814	791	432	125	3.6
Inspiration	36,326	81,696 C	10,721	1,589	1,310	2,363	.....	3.6	36,760	88,374 C	12,817	1,932	1,212	295	483	3.3
Kennecott (b)	189,115	220,610 C	37,372	16,255	12,259	9,397	.....	6.5	187,935	237,713 C	37,342	20,235	13,540	12,746	.....	7.2
Magma	7,780	29,135 C	3,901	1,574	1,210	1,224	.....	15.6	7,354	28,502 C	3,786	1,215	825	1,224	.....	11.2
Miami	17,254	55,289 C	7,470	1,596	(d) 1,138	840	.....	6.6	17,275	53,038 C	7,206	1,268	(d) 1,142	1,120	.....	6.6
Mohawk	4,358	16,738 C	2,386	837	799	575	.....	18.3	4,620	20,325 C	2,722	1,044	986	575	.....	21.4
Mother Lode	5,295	27,228 C	4,224	2,186	1,968	1,875	.....	37.2	3,782	20,588 C	3,012	1,416	1,182	1,250	.....	31.2
Nevada Con.	84,362	231,119 C	33,003	8,646	7,607	5,153	775	9.0	81,987	218,683 C	29,598	7,650	6,131	7,139	388	7.5
New Cornelia	37,461	82,312 C	11,772	4,318	3,714	2,880	.....	9.9	37,009	72,932 C	10,473	3,577	3,138	3,600	.....	8.5
Old Dominion	9,271	25,425 C	3,783	437	359	.....	.....	3.9	9,961	21,632 C	2,899	37	(k) 25	.....	.....	.....
Phelps Dodge	124,087	197,849 C	38,424	7,248	4,869	2,750	.....	3.9	118,538	184,858 C	32,985	5,530	3,623	3,000	.....	3.1
Tennessee Copper	17,061	12,566 C	9,661	1,508	1,038	820	56	6.1	16,916	11,063 C	8,520	1,043	404	503	94	2.4
United Verde Ex.	16,568	43,071 C	6,635	3,230	2,644	3,150	.....	16.0	16,567	41,301 C	5,802	2,278	1,707	3,150	.....	10.4
Utah Copper (c)	55,988	234,173 C	34,724	14,160	12,263	6,982	.....	21.9	60,562	233,002 C	32,738	13,718	11,519	6,678	.....	19.0
Engels	(j) 7,000	13,344 C	1,979	187	187	215	.....	2.7	(j) 7,454	12,121 C	1,665	174	138	.....	.....	1.9
Howe Sound (l)	16,206	35,166 C 56,831 L	14,009	4,284	3,107	1,488	.....	19.3	16,205	34,948 C 54,435 L	13,745	3,430	2,142	1,984	.....	13.2
Cerro de Pasco (e)	60,126	91,794 C	20,510	.....	(f) 7,821	5,614	.....	13.0	59,011	90,775 C	26,072	.....	(f) 9,355	4,491	.....	15.8
Total	987,433	1,840,988 C 56,831 L	307,169	96,018	81,706	61,489	3,321	8.30	965,244	1,841,212 C 54,435 L	297,846	90,585	75,123	64,948	3,453	7.80
Ex Utah, Howe Sound and Cerro	855,013	.....	.....	.....	58,515	.....	.....	6.85	829,466	.....	.....	.....	52,107	.....	.....	6.30
Lead-Zinc																
Bunker Hill and Sullivan	47,342	80,000 L 1,500 S	7,222	2,858	(d) 3,754	2,981	.....	7.9	47,203	94,000 L 1,799 S	6,932	2,567	(d) 3,357	2,993	.....	7.1
Bingham Mines	3,918	15,277 L 1,086 S	1,308	260	(d) 267	150	.....	6.8	3,811	19,034 L 1,423 S	1,595	306	(d) 311	200	.....	8.2
Chief Consolidated	5,740	31,566 L 2,577 S	2,537	602	564	495	40	9.8	5,170	21,261 L 1,950 S	1,772	314	233	.....	39	4.5
Consolidated M.& S.	27,398	262,000 L 7,178 S 135,092 Z	32,650	15,793	14,439	5,078	.....	52.9	28,215	291,000 L 7,179 S 147,054 Z	31,438	15,140	13,675	6,358	.....	48.5
Federal M. & S.	12,334	93,198 L 113,892 Z 1,779 S	12,795	3,638	3,308	3,146 (m)	.....	26.8	13,473	91,258 L 88,620 Z 2,187 S	10,122	2,251	1,823	1,300	.....	13.6
Hecla	3,447	59,055 L 1,648 S	4,545	2,805	2,543	2,000	.....	74.0	4,022	61,055 L 1,820 S	3,790	2,143	1,889	1,000	.....	47.1
Park Utah	8,712	4,237 S 39,538 L 32,900 Z	4,427	1,639	1,553	1,256	.....	17.9	8,790	4,997 S 50,000 L 49,000 Z	4,295	1,691	1,569	1,569	.....	17.9
Silver King Coalition	8,506	33,911 L 1,792 S	3,118	1,382	1,312	1,337	.....	15.4	8,591	38,128 L 2,438 S	3,185	1,460	1,853	1,337	.....	21.6
Tintic Standard	10,187	47,528 L 3,691 S	6,521	2,967	2,599	1,959	.....	26.0	10,056	43,680 L 3,295 S	4,984	2,270	1,824	1,959	.....	18.2
Utah-Apex	3,641	35,310 L 15,377 Z	2,641	809	781	686	.....	21.5	3,816	27,516 L 9,058 Z	2,402	417	367	.....	.....	9.6
Butte & Superior	5,349	69,790 Z 2,042 S	3,154	645	496	580	.....	9.2	5,116	79,786 Z 1,033 S	2,670	365	272	580	.....	5.3
St. Joseph Lead	36,472	32,400 Z 305,532 L	33,000 (d)	12,971	11,419	5,851	.....	31.4	32,585	49,200 Z 281,750 L	25,000 (d)	8,214	6,465	5,851	.....	19.9
Total	173,046	27,530 S 399,451 Z 1,002,935L	113,918	46,369	43,035	25,519	40	24.9	170,848	28,121 S 422,718 Z 1,018,682 L	98,185	37,138	33,638	23,147	39	19.7
Ex. Con. M. & S. and St. Joseph	109,176	.....	.....	.....	17,177	.....	.....	15.8	110,048	.....	.....	.....	13,498	.....	.....	12.3
Gold-Silver																
Benguet Cons	740	70 G	1,450	876	728	100	.....	98.5	832	50 G	1,036	429	292	200	.....	35.1
Cresson	1,240	66 G	1,377	277	277	488	.....	22.2	1,242	65 G	1,351	304	304	488	.....	24.5
Dome	8,313	190 G	4,191	1,784	1,228	1,906	.....	14.8	8,860	195 G	4,243	1,960	1,516	1,191	.....	17.1
Homestake	24,134	281 G	5,923	1,780	1,038	1,758	.....	4.3	25,116	322 G	6,827	2,822	2,107	1,758	.....	8.4
Hollinger (n)	34,771	712 G	15,656	8,025	6,833	5,805	.....	19.7	34,771	699 G	15,363	7,810	6,620	6,396	.....	19.1
Lake Shore	1,682	108 G	2,245	1,289	1,048	700	.....	62.4	2,043	150 G	3,127	1,890	1,681	1,200	.....	82.3
St. John del Rey (o)	8,400	90 G	1,875	272	202	160	.....	2.4	8,600	89 G	1,860	388	331	260	.....	3.8
Nipissing	6,008	1,966 S	1,270	115	(d) 164	720	.....	2.7	6,004	1,960 S	1,166	241	(d) 347	540	.....	5.8
Premier	5,429	126 G 3,187 S	3,782	2,199	1,817	1,600	.....	33.5	4,660	118 G 3,396 S	3,737	2,158	1,828	1,600	.....	39.2
Santa Gertrudis (o)	8,100	9,486 S	8,113	553	553	365	130	6.8	8,170	10,022 S	7,315	1,360	1,360	1,120	73	16.7
Teck Hughes	6,686	70 G	1,510	777	718	474	.....	10.8	6,686	102 G	2,160	1,152	1,016	713	.....	15.2
New York and Honduras Rosario	3,956	2,468 S	1,601	616	606	400	.....	15.3	3,984	2,165 S	1,341	439	428	400	.....	10.7
Wright Hargreaves	3,231	104 G	2,150	1,331	1,392	618	.....	43.1	2,914	104 G	2,151	1,007	1,068	1,237	.....	36.6
Total	112,690	17,107 S 1,817 G	51,143	19,894	16,604	15,094	130	14.7	113,882	17,543 S 1,894 G	51,677	21,960	18,898	17,103	73	16.6
Ex Hollinger	77,919	.....	.....	.....	9,771	.....	.....	12.5	79,111	.....	.....	.....	12,278	.....	.....	15.5

(a) Invested capital, net earnings and dividends, are adjusted to omit New Cornelia. (b) All items are adjusted to omit Utah Copper. (c) Invested capital, net earnings and dividends are adjusted to omit Nevada Consolidated on basis of 30 per cent ownership in 1926 and 43 per cent in 1927. (d) Includes miscellaneous income. (e) Produces about 12,000,000 oz. silver per year. (f) Depletion deducted. (g) Bond interest not deducted. (h) Based on market value of stock. (i) Depreciation and depletion estimated half and half. (j) Conjectural. (k) Loss. (l) Also produces important quantities of zinc and silver. (m) Includes $2,307,000 back dividends on preferred stock. (n) Figures for 1927 conjectural except production, net income and dividends. (o) Exchange at $4.86.

Table II—American Mining-Smelting-Manufacturing Companies—Earnings and Dividends, 1926 and 1927

Figures, Except Ratios, Are in Thousands

Company	1926						1927					
	Invested Capital	Profit: Operating	Profit: Net Before Depletion	Dividends	Bond Interest	Earnings-Capital Ratio	Invested Capital	Profit: Operating	Profit: Net Before Depletion	Dividends	Bond Interest	Earnings-Capital Ratio
Anaconda	(a) 351,666	22,490	17,605	(b) 2,120	10,255	5.0	(a) 353,713	21,287	16,522	(b) 2,019	13,382	4.7
A. S. & R.	185,640	26,123	20,327	8,074	2,567	11.0	185,636	23,944	17,983	8,379	2,506	9.7
New Jersey Zinc	(c) 50,000	.....	(d) 7,039	5,889	.....	14.0	(c) 50,000	.....	(d) 7,038	5,889	.....	14.0
International Nickel	70,729	7,191	5,610	3,346	167	8.0	71,710	7,768	6,169	3,881	123	8.6
National Lead	84,255	.....	(d) 9,004	3,358	.....	10.7	84,093	.....	(d) 4,929	3,590	.....	5.9
U. S. Smelting	69,476	7,007	(d) 4,524	2,931	485	6.5	69,512	5,837	(d) 3,476	2,931	445	5.0
American Metal	35,849	4,498	(d) 2,657	2,726	.....	7.4	40,052	4,822	(d) 2,513	2,133	.....	6.3
Total	847,615	.....	66,766	28,444	13,474	7.90	854,716	.....	58,630	28,822	16,456	6.85

(a) To avoid duplication "investments in sundry companies," $99,223,000 in 1926 and $98,115,000 in 1927, are deducted. *(b)* "Income from investment in sundry companies," $6,880,000 in 1926 and $6,981,000 in 1927 are deducted. *(c)* Conjectural. *(d)* Also includes depletion.

enterprise, is a wasting asset. That factor will be considered later in this article.

The data on which the accompanying tables and charts are based came originally from the published annual corporate reports of the companies. Those for the mining and smelting companies are taken directly from the reports themselves; those dealing with other companies are from the "Standard Earnings Bulletin" for May, published by the Standard Statistics Company. The item Invested Capital is the sum of all outstanding stocks, bonds, and surplus, as shown in the balance sheet of the company at the close of the year. Net Profit is the total income before providing for Fixed Charges, the principal item under this heading being interest on bonded indebtedness. The Earnings-Capital ratio is the quotient of Net Profit and Invested Capital; it is used as the most practicable yardstick for measuring the degree of prosperity of any company or any group. It is by no means ideal for the purpose, but seems to be the best available.

In the tables on mining-company results, Gross Income usually is the total intake from the sale of ore, concentrates, or bullion; Operating Income is the difference between Gross Income and actual operating expense. Net Profit usually includes miscellaneous income other than that from operation; depreciation has been deducted but depletion has *not*. Theoretically, at least, the charge for depreciation is an amount sufficient to keep the plant and equipment in such condition that it can operate efficiently as measured by standards of current practice. This leaves out of the picture only the charge for depletion, the one particular which distinguishes mining from other kinds of productive industry.

Examining the tables showing the results obtained by the individual companies, it is particularly noticeable—but at the same time natural—that the capital value of the property as set forth in the balance sheet has little relation to the actual value, so that too much significance should not be attached to the comparative Earnings-Capital ratios for the different companies. Methods of accounting vary widely, one important item being the policy with regard to charging depreciation. In some instances depletion is lumped with other charges; the disposition of federal and other tax accounts and of interest varies; and sundry income enters the accounts in different places. The companies in the so-called Smelting group—the mining-smelting-manufacturing enterprises—generally give fewer detailed figures than the others.

Another complication arises from the ownership of large stock interests in one or more of the companies by others in the list. To avoid duplication and make the aggregate figures represent the entire group as accurately as possible, adjustments have been made in Anaconda, Kennecott, Utah, and Calumet & Arizona as indicated in footnotes to the tables. In some instances, American Smelting & Refining Company for example, this could not be done because of the lack of necessary data.

Tables I and II supply most of the basic data from which the various charts are constructed. It will be observed that the exclusion of one or more companies in each group gives a decidedly different complexion to the picture, so far as the Earnings-Capital ratio is concerned. This is particularly noticeable in the lead-zinc group, when the two big properties, St. Joseph Lead and Consolidated Mining & Smelting, are omitted (see Chart I). Likewise, the exclusion of Hollinger, and of the three copper companies, alters the position. Utah has a low capitalization compared, for instance, with Chile Ex., which has about the same output; Cerro de Pasco, on account of its silver production of 12,000,000 oz. per year, and Howe Sound, which produces lead, zinc, and silver on a large scale in Mexico, are hardly comparable with the other "coppers," though they are usually classed as such.

Table III summarizes some of the essential data for the

Table III—Summary of Results in 1926 and 1927

Production	1926	1927
Copper, lb	1,840,988,000	1,841,212,000
Lead, lb	1,002,935,000	1,018,682,000
Zinc, lb	399,451,000	422,718,000
Gold, oz	1,817,000	1,894,000
Silver, oz	44,637,000	45,664,000
Value of production	$472,230,000	$447,708,000
Operating profit		
Copper	$96,018,000	$90,585,000
Lead-zinc	46,369,000	37,138,000
Gold-silver	19,894,000	21,960,000
Total	$162,281,000	$149,683,000
Net before depletion		
Copper	$81,706,000	$75,123,000
Lead-zinc	43,035,000	33,638,000
Gold-silver	16,604,000	18,898,000
Total	$141,345,000	$127,659,000
Dividends and interest		
Copper	$64,810,000	$68,401,000
Lead-zinc	25,519,000	23,147,000
Gold-silver	15,094,000	17,103,000
Total	$105,423,000	$108,651,000
Smelters	41,918,000	45,278,000
Grand total	$147,341,000	$153,929,000

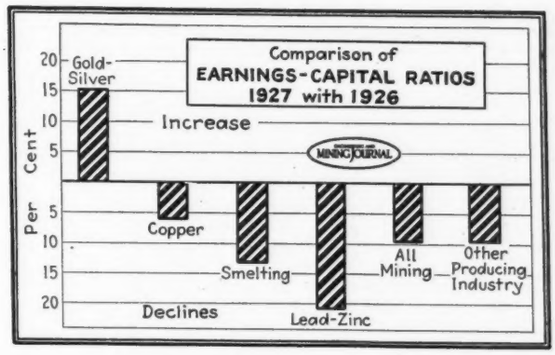


Chart III—Showing Comparison of Group Ratios

two years. Production of each of the metals, zinc in particular, was greater in 1927 than in 1926; yet the gross sales values of the metals was 5.3 per cent lower, as a consequence of the lower prices that prevailed for each of the metals—gold, of course, being excepted. At the same time, operating economies obviously were effected. Even allowing for the increased earnings of $2,000,000 in the gold-silver group, the decline in operating profit was only $15,000,000, in round figures, compared with a shrinkage of $25,000,000 in the value of the metals. An interesting comparison is this: The average profit per pound of copper in 1926 was 4.44c., which subtracted from 14.02c., the average Connecticut price, gives an apparent cost of 9.58c. A similar calculation for 1927 shows 4.075c. to be subtracted from 13.145c., giving 9.07c. This indicates a reduction in production cost of 0.51c. per pound.

No less significant is a comparison of the apparent unit costs of lead-zinc producers. In 1926 about 1.4 billion pounds of the two metals was produced at an average profit of 3.07c. per pound; in 1927 the production was 1.44 billion pounds and the average profit 2.33c., a decline of 0.74c. However, if the average selling prices for the metals are weighted in the approximate proportion of production, a decline of 1.5c. per pound in the composite selling price is shown. Credits for silver are of course involved in both years; but a reduction of production cost of 0.76c. per pound of base metal is indicated. Dividends of mining companies increased in the aggregate somewhat more than is accounted for by gold-silver producers. When the Smelting group is included the picture is distorted somewhat by the fact that Anaconda's bond interest increased by slightly more than $3,000,000. However, it is fair to say that the increase in dividend disbursements reflected to an extent the excellent earnings of 1926. The reason that the Utah Copper dividend appears to have decreased is that its income from Nevada Consolidated was considerably greater, because of its increased share holdings and of the higher per-share rate of Nevada's distribution.

Chart II discloses graphically various relations between operating profit, income, and dividends in the two years and for the various mining groups. It indicates the comparative large ratio of profits to gross income in gold-silver mining; and also the decline in margin of profit due to the lower prices for the base metals, particularly lead and zinc.

To sum up the two years: The lower metal prices caused a decline of 9.7 per cent in the Earnings-Capital ratio for the entire industry. Incidentally, the decline in the *E. & M. J.* Weighted Index for Non-Ferrous Metal Prices from 107.74 to 97.54 was 9.5 per cent. However, if the selling price for a product declines 9.5 per cent, profits should decline much more than that, *unless,* as is the fact in this instance, a material lowering in the cost of production is effected. Apparently the consumer has had the benefit of this reduction in costs—and then some.

Turning next to the comparison of mining with other industries: Chart IV shows the Earnings-Capital ratios of the mining companies collectively and broken up into classes, and of eighteen groups of industrial companies engaged in the production of raw or refined materials or of manufactures. Some other groups might have been included, but that would not have altered the situation appreciably. Incidentally, the following approximate figure for 1927 for "non-producing" industries may be mentioned: telephone and telegraph, 7.8; traction and motor transportation, 5.7; railroads, 4.8; chain, department, and other retail stores, 15; theaters and motion pictures, 8.1.

The most prosperous industry in 1927 was the manufacture of automobiles and trucks, but it is rather astonishing to find that if General Motors be eliminated the ratio for the industry becomes 10.7 instead of 21.1 per cent. The G.M. income, before fixed charges, was 31.2 per cent of its huge invested capital—$757,735,000. No wonder the public has been crazy to buy the stock at phenomenal prices! At the opposite extreme is found the coal and coke industry—notoriously unhealthy—with only 2.1 per cent. Steel and iron with 4.9 and petroleum with 5.7 per cent are comparatively low.

Now, what about the metal mining industry? On their face, the data in this chart disclose a highly satisfactory position. Including the so-called "smelting" group, the average Earnings-Capital ratio is 8.9 per cent, just ahead of a composite—not average—for all industries in the list except the four mining groups. The difference between 8.9 and 8.0 per cent is, however con-

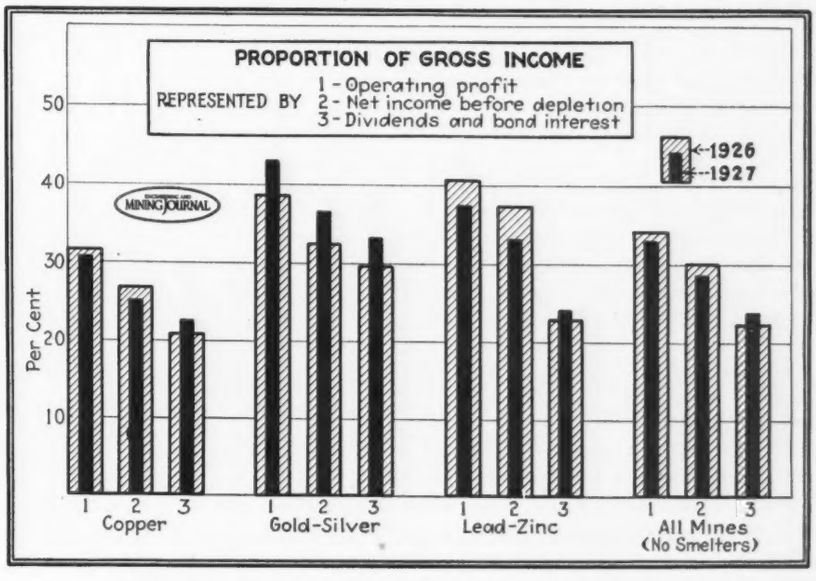


Chart II—Showing Disposition of Group Income

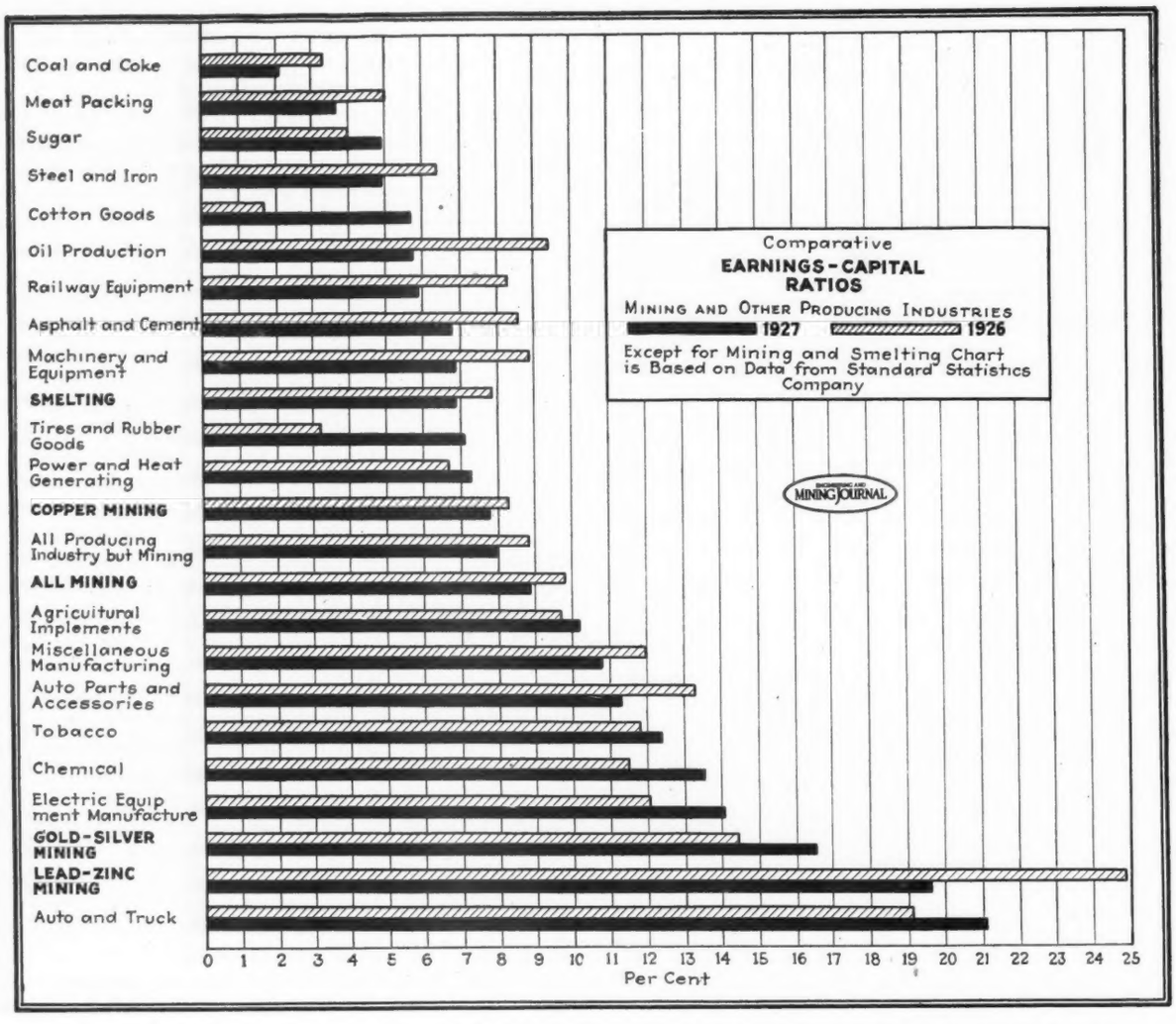


Chart IV—Showing Comparison of Mining Groups with Other Groups of Productive Industry

siderable. Segregating mining according to metals, and omitting the two composites, there are 22 entries for honors. Of these second, third, tenth, and thirteenth places go to mining. Failing to get into General Motors, the evidence suggests that the public ought to find ample consolation in a lead or zinc mining company. Even gold and silver has much to attract, presuming, of course, that the market price of the shares is right. The Average Investor, it must be admitted, does not scrutinize this question of price as much as he ought, but in this respect there is nothing particularly distinctive in his attitude toward mining. There is, however, a factor that distinguishes mining from virtually every other industry, one that is entirely overlooked by, say, eight investors out of ten, and one that complicates the apparent simple procedure of looking at a chart like No. IV and a table like Table II and telephoning your broker to buy some Consolidated Gold or United Zinc-Lead. I use imaginary names to avoid any possibility of giving a tip that might turn out badly.

This vital factor is the depletion of the orebody. Except for some slight salvage value, the plant of a mining property is valueless when the ore is exhausted. *The* underlying asset is ore; and the ore some day is sure to play out. Any intelligent guess at the value of a mine *must* be based on some estimate of the life of the property. If a mine is going to be exhausted in five years one should get annual dividends of 26 per cent in order to realize 8 per cent interest and amortize his original capital, on the basis of 4 per cent interest on sinking fund. If the life of the mine is ten years the annual dividend need be only 16 per cent; if it is forty years not quite 9 per cent will be needed. If it is a little longer the question of mine depletion or amortization—which involve essentially the same problem—disappears entirely.

Presumably the life of a railroad, a factory, or a cement mill, if plant and equipment are maintained from depreciation reserve, will be more than forty years. If the same thing could be said of all gold or lead or copper mines, one could assert with some assurance, and without any qualifying statement, that the mining industry, by and large, enjoyed better than average prosperity in 1927.

Unfortunately, there is every likelihood that by 1940 from one-fourth to one-third of the mines that are represented in the accompanying tables will be dead; some of them have a life of only four or five years ahead of them. One tendency that should not be overlooked is the growing prevalence of the policy of spending part of current profits in a search for new mines to perpetuate the life of the company, after the present mining properties are exhausted. The large companies, with strong resources, are particularly active in this respect. In the

light of the foregoing the comparative positions of the various mining groups as shown graphically on Chart IV are logical.

The lowest, Smelting, at 6.9 per cent, is ahead of nine important industries and is on a par with the machinery and equipment group, in which, incidentally, may be found such well-known manufacturers of mining machinery as Allis-Chalmers, Chicago Pneumatic, Fairbanks-Morse, Ingersoll-Rand, and Worthington. Smelting, refining, and manufacturing are the most important sources of revenue of this group, though the position of each is different from that of the others. International Nickel is the only one that derives all of its ore from a single group of mines, but it has known reserves sufficient for more than fifty years. Accordingly the factor of depletion can for practical purposes be ignored. Mining is little more than an incidental part of the activities of National Lead, and yet it, like the other five companies, has resources which enable it to finance exploration, development, and operation of new properties. The exhaustion of no mine or mines should be a controlling factor in the prosperity of these companies. They are comparable with "industrials." As to the relative position of the group, one might wish that it were higher, but must admit that it might be much lower.

Copper, at 7.8 per cent, stands higher than Smelting, but a little lower than the composite for mining and other industries, and far below the gold-silver and lead-zinc groups. This relative position is justified by the fact that the "coppers" for the most part have greater expectation of life than the others. Some of the smaller ones soon will drop out; but most of the big producers in Arizona, Utah, Nevada, and South America have assured reserves for upward of thirty years.

Generalizations must be made with care. Nevertheless it is fair to say that the average life of the mines in the two remaining groups will be much less than that of the copper group. Eliminating St. Joe and Consolidated Mining & Smelting, the Earnings-Capital ratio of the lead-zinc group is 12.3 per cent. On the basis already assumed these companies would have to have an average life of seventeen years at the current rate of earnings to be considered profitable enterprises.

The date from which to start the period of productive life depends upon the purpose of the analysis. For the individual who put his money into an enterprise at the very start, the life would begin at the time dividends started on the scale assumed in the calculation; or more accurately at the time when dividends had been paid in sufficient amount to provide him interest on his money during such period as was required to put the property into production and on a dividend-paying basis. This is a more or less academic interest, however; the practical viewpoint is that of the buyer of the shares at the present time. For him the birthday of the enterprise is the day on which he makes the purchase. Likewise the holder of shares should consider the advisability of holding them or selling at the market on the same basis. The seventeen-year period—or any other necessary period—must extend into the future!

The basis of this article has been the relation of earnings to invested capital. Only passing mention has been made of the valuation placed upon the companies by the public as reflected in the current quotation for the shares. It is possible, however, given the essential data as to the value of bonds and the number of preferred and common shares outstanding, to translate the findings into terms of the intrinsic value of common shares. Speculative value is another matter—but incidentally it is the factor that governs the quotations on most of the shares today.

The conclusions now to be enumerated seem justified.

(1) Although mining in 1927 was about 9.7 per cent less profitable than in 1926, the fact that 1926 was regarded generally as "very satisfactory" warrants characterizing 1927 as "good."

(2) Compared with other producing industries, mining ranks well above the average so far as the Earnings-Capital ratios are concerned; but when due cognizance is taken of the fact that an ore deposit is a wasting asset, the status is not so satisfactory.

(3) As in other industries results tend to be erratic; some companies in a group do phenominally well, whereas others perform indifferently.

(4) Substantial reduction in the costs of production have been effected, but the benefit of these has gone entirely to the consumer of metals.

(5) The trend toward the exploitation of deposits of lower grade but larger extent, and the consequent increase in the average life of a mine; and the growing practice of established operating companies to seek and finance new properties and to diversify their interests, tends to place them properly in the class of "industrials" and to reduce the margin by which earnings should be greater because of the incidence of the factor of ore depletion.

United States Third in Per-Capita Consumption of Electricity

OUTPUT of electricity by public-utility power plants in the United States in 1927 was 80,205,000,000 kw.-hr., according to revised figures just published by the U. S. Geological Survey. The increase in output from 1926 to 1927 was about 9 per cent. The amount produced by water power was about 37 per cent of the total, against 35½ per cent in 1926.

Net importation of electricity from Canada in 1927 was 1,629,000,000 kw.-hr. The total amount of electricity from public-utility sources utilized in the United States was therefore 81,834,000,000 kw.-hr., equivalent to 690 kw.-hr. per capita. The corresponding figure for Canada in 1927 was 1,320 kw.-hr. per capita.

Why Metallurgists Should Use the Microscope

WITH the basic technique of leaching practice thoroughly established, opportunity arises to study refinements and to peer beneath the surface. In a forthcoming article in *"E. & M. J."* Mr. R. E. Head, a microscopist on the staff of the U. S. Bureau of Mines, describes how the microscope may provide information of value in determining the leachability of copper ore, how and where the various minerals occur in the crushed particles, and to what extent fracturing affects the extraction results. The article will prove provocative of thought and suggestive of investigation.

The Meteor Crater Project

Present Status of the Search for the Head of a Comet in the Arizona Desert

(Part VII of a Series: Revisiting Arizona Mining Camps)

By E. H. ROBIE
Associate Editor

PROCEEDING southward from Jerome or Clarkdale to the other mining districts of Arizona, one now has a choice of two stage routes: one leads over the mountain to Prescott and thence down the Black Canyon road to Phoenix; and the other down the Verde River valley, along Fossil Creek and the Tonto rim, made famous by Zane Grey, through Payson and by way of the Roosevelt dam to Miami and Globe. I understand that this is a very scenic ride and one that is virtually unknown to tourists. To the east of Payson are quicksilver and asbestos properties in process of development. There is also a road from Cottonwood up Oak Creek Canyon to Flagstaff, but no stage service.

My route led me southward over the highway first mentioned. The elevation of the Verde River is about 3,300 ft., and that of the Clarkdale smelter about 100 ft. higher. Up the hill to Jerome is a climb of about 1,700 ft.; it is indeed a beautiful sight to look toward Jerome from Clarkdale at night, with the lights of the town appearing like a star cluster on the southwestern horizon, and it is inspiring to look down from Jerome over the Verde River valley, with the colorful cliffs of the canyon in the distance. Were it not for the fact that the Grand Canyon of the Colorado is not far away, the Verde River canyon, with its beauty and historical associations, would be much more of a magnet for tourists.

From Jerome, with an elevation of 5,100 ft., the road rises to an elevation of about 7,000 ft. to cross Mingus Mountain, the summit of which is about 800 ft. higher. It is densely wooded, and early in March was covered with patches of snow, though the weather was exceedingly mild in the valleys below.

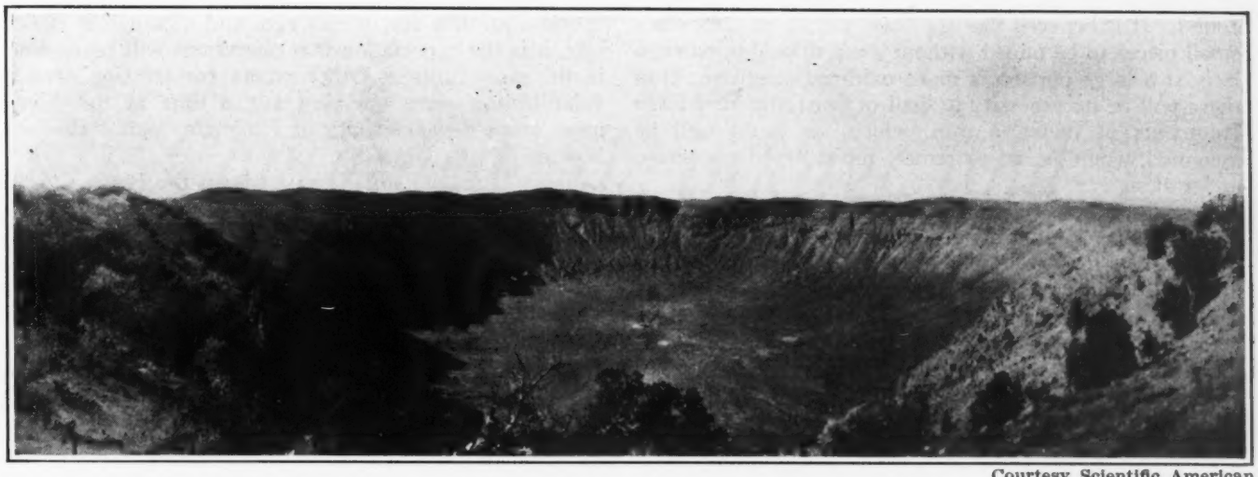
At Humboldt, a few miles south on the Black Canyon Highway, I had a talk with G. M. Colvocoresses, who is manager of the mines, mill, and smelter of the Southwest Metals Company, which were owned and operated by the Consolidated Arizona Smelting Company until 1922, when the Southwest Metals was organized and took possession. At present this property is inactive, except for the operations of leasers on the Blue Bell and De Soto mines. The concentrating mill was leased during the latter part of 1927 to the Phelps Dodge Corporation, which planned to remodel it for the treatment of lead and zinc ores, but after investigation of the local ore supply and other conditions cancelled its lease with the beginning of this year.

The development of lead and zinc mines in this vicinity has not yet progressed to a point where substantial shipments can be counted on, and the price prevailing for copper is not attractive to most of the possible shippers, but the office at Humboldt is being maintained, and Mr. Colvocoresses utilizes this also as the operating office of the Meteor Crater Exploration & Mining Company and the Western Metallurgical Company.

In reference to the Meteor Crater company, most of my readers have heard of the Meteor Crater, which is a huge bowl located in the plain between Winslow and Flagstaff, being over three-quarters of a mile in diameter and 570 ft. deep from the edge of the rim to the present bed. The occurrence of this peculiar phenomenon has been generally attributed to the impact of a mass of meteoric material, a theory corroborated by the many thousand fragments of meteoric iron which have been found directly surrounding the crater or mixed in with the ejected material constituting the rim. It is now generally believed by those who are interested in the exploration that the hole was formed by the head of a small comet which was in reality composed of a compact cluster of many individual units of meteoric iron, some of which contained sufficient chlorine to oxidize on exposure to atmospheric conditions, and form the great quantity of meteoric iron shale which is found in this vicinity. The main body of the meteorite or comet is thought to lie about 1,500 ft. below the south rim of the crater, and to be composed, as mentioned above, of a great number of small fragments, many of which will be found partly or entirely oxidized, so that they will resemble hematite iron except for the fact that they are magnetic and contain a substantial percentage of nickel as well as a small amount of metals of the platinum group.

Attempts to develop the meteoric mass were made from 1903 to 1908 by the Standard Iron Company of Philadelphia, which sought the orebody by shaft and drill holes in the bottom of the bowl, but failed to find anything more than isolated fragments. Again in 1921 and 1922 the United States Smelting, Refining & Mining Exploration Company spent a large amount of money putting down a churn-drill hole from the south rim of the crater, and conducted some other exploration near the surface. The drill eventually reached a depth of 1,376 ft., at which point the bit jammed, very likely between two large fragments of meteoric iron, and the cable was broken in trying to lift the tools. For the last 200 ft. a considerable quantity of oxidized meteoric iron had been brought up with the sludge from the drill, making it seem highly probable that at least a portion of the main meteoric mass had been located at this point. Although some officials of this company still had faith in the enterprise, the directors refused to sanction the large additional appropriation which would have been necessary to sink a shaft and carry out further exploration.

The property has now been leased to the Meteor Crater Exploration & Mining Company, which started active work early in this year and which is financed largely by



Courtesy Scientific American

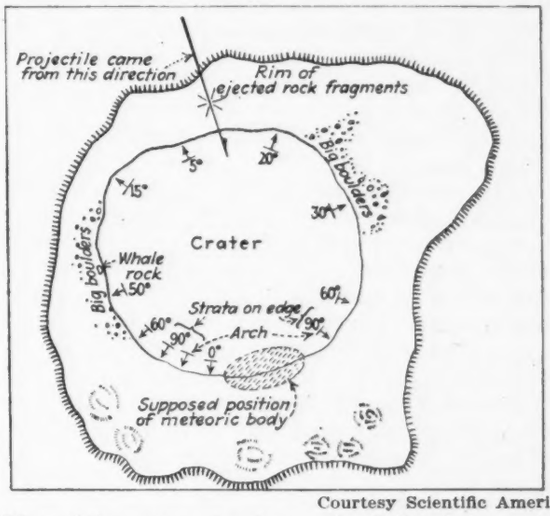
Looking toward the north rim of Meteor Crater, which is nearly a mile in diameter and 570 ft. deep

Boston and Philadelphia capital, with head office in the Real Estate Trust Building, Philadelphia, and operating office at Humboldt, Ariz. The officers of this company are Quincy A. Shaw, president; D. M. Barringer, vice-president; Charles Henry Scott, Jr., secretary; Brandon Barringer, treasurer; G. M. Colvocoresses, general manager, and the board of directors is composed of the gentlemen named above, together with George R. Agassiz and Ledyard Heckscher.

The preliminary work, consisting of diamond drilling to pilot the formation surrounding the crater and to determine the most suitable place for sinking the shaft, has now been completed, and the location of the shaft at a considerable distance south of the crater has been picked; the actual shaft sinking was expected to start this month.

In the vicinity of the crater the sedimentary rocks lie horizontal and undisturbed, except where broken and tilted up by the impact of the meteoric mass, and the upper layer consists of brown tertiary sandstone, locally known as "Moencopie" sandstone, underlain by Kaibab limestone, below which in succession are found the Coconino sandstone and the Red Beds sandstone, these last formations all having been formed during the Carboniferous era.

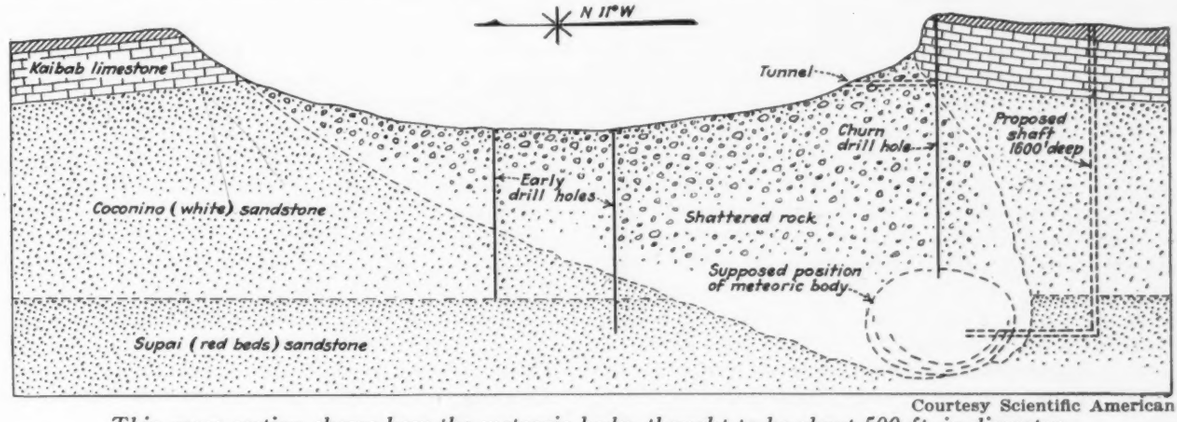
It is believed that the meteoric mass lies approximately on the contact between the white, Coconino sandstone and the Red Beds, or possibly slightly embedded in the Red Beds. The shaft will be sunk to a depth of about 1,600 ft., and from the bottom a crosscut driven to a point directly below the bottom of the United States company's drill hole, where the main mass of meteoric material is supposed to rest. This work should be completed in a year or fifteen months, dependent on underground conditions.



Courtesy Scientific American

Map of the crater, showing angle of dip of the strata around the rim

The methods of mining and the subsequent treatment of the meteoric material will depend on what is actually



Courtesy Scientific American

This cross-section shows how the meteoric body, thought to be about 500 ft. in diameter, is supposed to have smashed its way into the sandstone

found. It is believed that the mass will be in sufficiently small pieces to be mined without great difficulty, particularly if a large portion is in an oxidized condition; thus there will be no necessity to drill or blast any very large fragments of meteoric iron, which, as could well be imagined, would be an extremely difficult and expensive undertaking.

Samples of oxidized meteoric material average approximately 62 per cent iron, 5.9 per cent nickel, 0.2 oz. in platinum per ton, and 0.1 oz. iridium, whereas the unoxidized meteoric material averages 93 per cent iron, 6.4 per cent nickel, 0.35 oz. platinum, and 0.16 oz. iridium. As will be noted, the gross value of both classes of material is quite substantial at present market figures for the metals mentioned, and metallurgists who have investigated the treatment of this ore do not believe that there will be any great difficulty in recovering a large percentage of these metals. The simplest method for treatment might involve the making of a ferro-nickel, but by such a process the precious metals could not be recovered, and as these constitute the most valuable portion of the contained metals it will probably be preferable to flux the meteoric ore with some sulphur-bearing material and form a nickel matte, which can afterward be roasted, reduced and electrolytically refined, involving the loss of the iron (which at this particular locality is not of any great commercial value), but permitting the recovery of a great percentage of the platinum metals.

From time to time feature stories concerning this Meteor Crater have appeared in popular magazines and newspapers, generally with but little regard for the facts and wherein the writers have drawn heavily on the imagination. Very excellent scientific articles have been published in the *Proceedings* of the National Academy of Science, and more recently in the *Scientific American* of July, August, and September, 1927, but the former at least have not had any wide popular circulation.

The exploration and development of this unique orebody is indeed fascinating and—being highly speculative, and as the interested parties frankly state, "an out-and-out gamble"—it is fortunate that the search is being sponsored and financed by men thoroughly cognizant of the uncertainties and difficulties of the project and willing and able to afford the risk involved.

The Western Metallurgical Company, in which both Southwest Metals Company and the Western Precipitation Company, of Los Angeles, are heavily interested, has done some interesting metallurgical work at Humboldt and elsewhere, developing the chloridizing-volatilization process which was originally patented by Stuart Croasdale, of Denver, his process now being supplemented by the addition of the Cottrell method of electric precipitation for recovering the fumes. By this process the crushed ore is mixed with salt and heated in a rotary kiln to 900 or 1,000 deg. C., whereupon the volatile chlorides pass off in a fume to be precipitated in the Cottrell treaters, the precipitated fume containing the great bulk of the gold, silver, copper, and lead which may be found in the ore so treated. This process has a limited application, principally to certain siliceous oxidized ores which contain elements making them difficult to concentrate by flotation or to treat by leaching. The process has also been used to some extent for the separation of the metals mentioned from zinc, which volatilizes only at a considerably higher temperature, and generally remains in the sinter or unvolatilized material left in the kiln. For this latter purpose a plant was recently erected in the town of Kingman by W. S. Murray and operated until a few weeks ago, and although it is now idle, it is the expectation that operations will be resumed in the near future. Other plants for treating ores by volatilization were operated for a time at the Signal mine, some distance south of Kingman, and at Pachuca, Mexico.

From Humboldt to Phoenix, down the Black Canyon highway, is a trip of 90 miles, but not a particularly exciting one. One passes a few small mines and prospects. At Canon, where the stage stops for lunch of a sort, the dump of the Kay Copper Corporation may be seen on the hillside. This enterprise had a checkered career on the New York Curb, from which it was finally dropped; efforts are now being made at reorganization Lack of sufficient commercial ore to make the prospect pay its way seems to have been the stumbling block. An old-timer on the lunch-room steps told me that recent activities had been confined to keeping the workings unwatered and that the property was virtually deserted. At a little distance from the road, the old Tip Top property, in the Bradshaw Mountains, is again active, and has purchased the milling equipment of the Arizona Binghamton, at Stoddard.

I was surprised to see what a bustling city Phoenix has become. Irrigation, which is being extended further and further each year, has done wonders for the community, and the crops are becoming more diversified. Going into the city, we passed through hundreds of acres of lettuce farms, with shipping sheds clustered along the railway. A fine new hotel, the San Carlos, was opened the day I was there, supplementing the excellent facilities of the Adams and the others.

From Phoenix to Superior is a ride of 67 miles, stages leaving Phoenix at 8 and 10.15 a.m., and at 6 p.m., for the two-hour ride. Hotel accommodations at the Magma Hotel, in Superior, are satisfactory, though the town's dining facilities leave something to be desired. It is a lively little town, however; said to be one of the livest mining camps in Arizona nowadays.

During his stay in Superior, Mr. Robie visited the operations of the Magma Copper Company, with special reference to the mill and smelter, and also looked over the property that the Belmont Copper Mining Company is developing. His notes will appear in an early issue.

United States Magnesium Sales · Gain 14 per Cent

SALES of magnesium produced in the United States in 1927 amounted to 366,400 lb., valued at $441,700, compared with sales of 322,650 lb., valued at $390,400, in 1926, according to J. M. Hill, of the U. S. Bureau of Mines. Of the magnesium sold in 1927, 69 per cent was in ingot form at prices ranging from 58 to 93c. a pound, and such sales increased over 6 per cent compared with 1926. Sales of sheet magnesium in 1927 were 3 per cent of the total sales of magnesium and were 159 per cent greater than in 1926. Sales of castings in 1927 were 31,990 lb., a decrease of 13 per cent compared with 1926. Sales of wire decreased 13 per cent, but those of tubing increased 94 per cent compared with 1926. The average price of domestic ingot metal in 1927 was 68c. a pound, that of powder $1.56 a pound, and of castings $1.84 a pound.

Imports of magnesium metal in 1927 were 7,131 lb., valued at $8,402, compared with 10,117 lb., valued at $4,750, in 1926.

Combined Shrinkage and Caving Methods

CONCLUDING INSTALLMENT

By CHARLES A. MITKE
Consulting Mining Engineer, Phœnix, Ariz.

IN THIS issue Mr. Mitke continues his discussion of combined shrinkage and caving methods which he started on May 12. In the first installment, he discussed the preparatory development work, width of stopes and pillars, spacing of grizzlies, and the interval between haulage and grizzly levels; also the subjects of grizzly level development at various properties, shrinkage stopes with simultaneous pillar caving for harder ores, and floor and boundary shrinkage stopes. The present installment opens with a discussion of the various methods in use for breaking ore in shrinkage stopes.

1. Stoper Machines in Room-and-Pillar Stopes—In ordinary room-and-pillar shrinkage stopes, with fairly firm back, stoping drills are used to advantage. These machines can quickly be set up on the broken ore, and in many operations 150 to 200 ft. of hole can be drilled in an eight-hour shift. These holes are vertical, and the miner drills the ore directly over his head. In general, where ground conditions permit its use, this method of breaking is one of the most economical. Stopers are used at Ray, Morenci, Braden, in Michigan, and in many of the gold mines of Canada. They were also employed in the shrinkage stopes at Miami. Powder consumption at Morenci ranges from 0.33 to 0.54 lb. per ton. The total mining cost at Ray (exclusive of depreciation, taxes, and preliminary mine development, but including all other overhead) was 77c. for 1927.[9] Preliminary mine development, which covers sinking of main hoisting shafts, concreting of long haulage tunnels, and similar work, amounts to 15c. per ton.

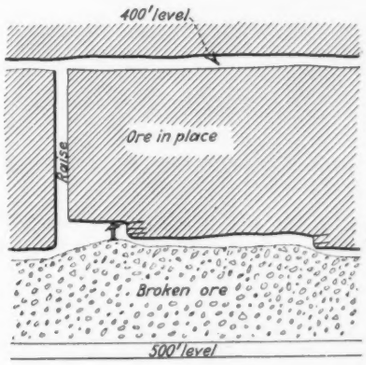


Fig. 6—Breaking ore in shrinkage stopes with drifting machines, drilling horizontally in step-like slabs

2. Drifting Machines in Room-and-Pillar Stopes—In some classes of ground, the stoper machine shakes up the back immediately over the miner's head to such an extent as to cause pieces of ore to fall off, and thus make the work dangerous. Under these conditions drifting machines are used. Instead of drilling vertically, the miner drills horizontally, breaking the ore off in step-like slabs. (See Fig. 6.) This is the more general method employed in the shrinkage stopes at Homestake, at the Creighton mine, and in some of the Michigan iron mines. Sullivan D.R. 6's with 16- to 20-ft. steel are used in stopes at Creighton, and the powder consumption is approximately 1 lb. per ton (which includes blockholing), as the rock is hard.

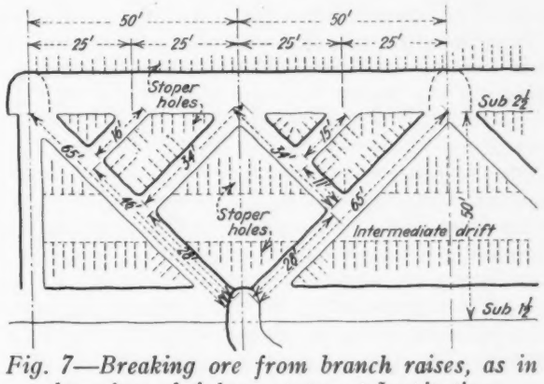


Fig. 7—Breaking ore from branch raises, as in boundary shrinkage stopes at Inspiration

3. Stoper Holes From Branch Raises—In breaking ore in the narrow boundary shrinkage stopes at Inspiration, the incline-raise system has been used to advantage. First, a number of short incline raises are put up from the bottom of the ore, and parallel drifts driven. Numerous branches extend from these incline raises. (See Fig. 7.) The miners go into these branch raises and drill stoper holes at regular intervals, wherever practicable, and down holes with jackhammers in the drifts. In this manner, a block which is once developed with raises can quickly be shattered from one end to the other. This method can be used in ground which is hardly firm enough for straight shrinkage with stopers only, proceeding from the bottom upward. Powder consumption is about 0.35 lb. per ton.

4. Large Powder Blasts in Short Crosscuts From Vertical Raises—In 1920, a form of shrinkage stoping was employed to mine ore immediately beneath a fire in a timbered top-slice at the Coronado mine of the former Arizona Copper Company (now absorbed by Phelps Dodge). Vertical raises, driven at an earlier period to facilitate top-slice mining, were already in place. From

[9]Annual Report, 1927.

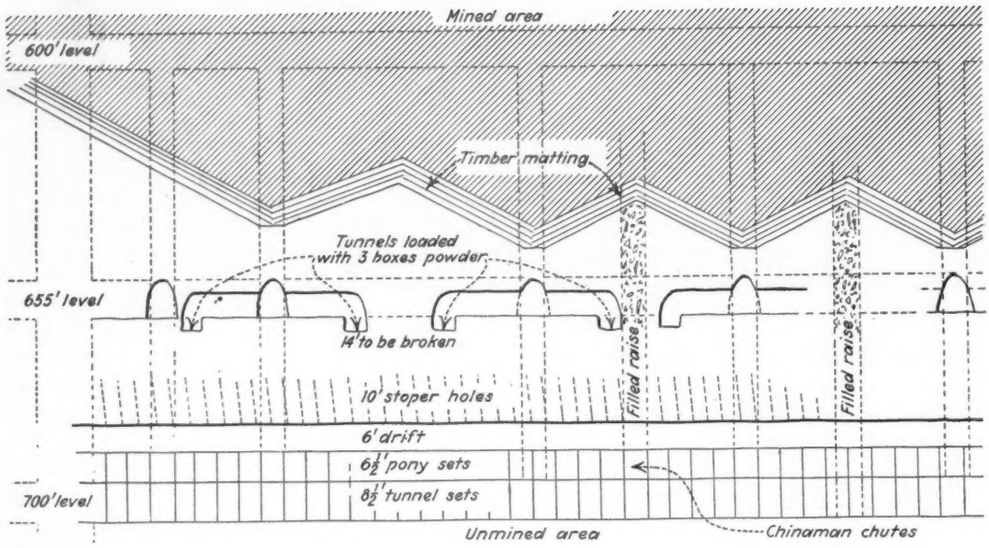


Fig.8—Breaking ore in shrinkage stopes by means of large powder blasts. (Coronado mine, Arizona Copper Company.)

these, short crosscuts were driven, and large blasts of powder placed in the ends of each. Where the ore was high enough to permit a series of crosscuts, one above the other, these were reached by manways from raises already driven in the hanging wall of the vein. Boulders were broken in the pony sets, where the ore was drawn through "Chinaman" chutes. Much of the ore extracted was literally on fire, so that water lines with hoses were kept in the pony sets, to protect the drift timbers, when burning ore was drawn through the chutes. The amount of ore extracted by this method was 189,517 tons with an average extraction of 97 per cent. (See Fig. 8.)

A similar variation, only on a much larger scale, is in operation at the Alaska Juneau property. Blocks, varying from 750x250 ft. to 200x240 ft., are prepared for stoping. From the undercutting level, incline raises, 100 ft. apart, are driven up to the mining level 200 ft. above. From these raises, vertical intervals of approximately 35 to 50 ft., small radial drifts, 40 ft. long, are driven into the ore. Large powder charges are then placed in the ends of these short drifts, and, when fired, break off thick layers of ore from the back. Blasts in the ends of these powder drifts involve the use of as much as 200 cases of powder. About twenty tons of ore is said to be broken by each pound of powder in the primary blasting. Approximately 71 per cent of the blasting is secondary and is done in the bulldozing chambers below. Powder consumption is about 0.25 lb. per ton. Mining cost is approximately 23c., plus overhead of 0.19c., or a total of 25c. Of this sum, prepaid mining, or amortization of original investment, amounts to 0.02c.; stoping to 0.015c.; bulldozing 0.1098c.; and tramming 0.08c. The Ingersoll-Leyner water drill, No. 240, is used for most stope work.[10] (See Fig. 9.)

5. Long Stoper Holes Driven With Heavy Jackhammers From Incline Raises—At Latouche, and also at Mount Hope, N. J., the stope ore is broken by means of long radial holes drilled from the incline raises. These raises are spaced from 40 to 60 ft. center to center. Holes up to 20 ft. in length are driven. The first sets of holes are driven about 20 ft. up from the bottom of the incline raises, which are widened out at this point to permit the men to work. All men and supplies enter the raises from the level above. If the ground is very hard, from 35 to 40 holes are necessary in each raise, though if the ground is soft and somewhat cracked, only 20 to 26 holes are required. A slab of ore approximately 20 ft. thick is broken off with each blast; then drilling is resumed 20 ft. higher up, and so on until the entire height of ore in the stope has been broken. The holes from each raise are usually fired as a single charge, and the amount of powder per round varies at Latouche from 500 to 1,000 lb., depending on the number of holes. The powder ratio for stoping is said to be 0.16 lb. for each ton of ore. Total cost is 79c. per ton, made up of 29c. for developing; 15c. for ore production in primary blasting; 0.208c. for bulldozing; and 0.137c. for tramming and hoisting. Preliminary development work, apportioned over the total tonnage of 2,603,259 tons, is reported as approximately 5c., which also includes the cost of diamond drilling. This, if deducted from the total cost of 79c., leaves a straight mining cost of 74c.[11]

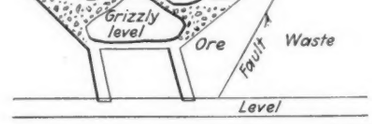


Fig.9—Breaking ore at Alaska Juncau, with large powder blasts

Bull Moose machines (Ingersoll-Rand Jackhamers), with 1⅛-in. hollow hex., are used in stoping.

Here, as at Alaska Juneau, ordinary shrinkage is first used to undercut the ore, which is then drawn to provide sufficient space not only for men to work in but to take care of the expansion of broken ore from above. (See Fig. 10.)

6. Large Blasts Set in the Bottom of Churn-Drill Holes Driven From Surface—At Neihart, Mont., where the ore comes within a few hundred feet of the surface, the primary blasting is done from churn-drill holes. Ordinary shrinkage stopes, 20 ft. wide, are carried up

[10] "Estimate of Ore Reserves and Mining Methods," Alaska Juneau. P. R. Bradley, A.I.M.E. 1924. Also "Underground Coyote Blasting at Alaska Juneau." J. A. Williams, *The Explosives Engineer*, November, 1926.

[11] "The Latouche System of Mining." Tech. Pub. No. 20, A.I.M.E., 1927.

about 60 ft., with pillars between. Churn-drill holes are drilled from surface, outside the limits of the stopes, and blasts set off from the bottom of these. This breaks the ore into the shrinkage stopes, and blasts are also set off in the bottom of these churn-drill holes as frequently as ore is required. The pillar is undercut by means of crosscuts driven on an incline, until eventually the inner pillar is completely undercut, and the full width of the resulting arch becomes 140 ft. This caves to the surface. The maximum width of the orebody is 400 ft., with a length of 600 ft. Development cost in this operation is 30c., with a mining cost, which includes management and overhead, of 42c., or a total of 72c. on a daily production of 600 tons.[12] (See Fig. 11.)

Preparatory development work necessary for breaking the ore by either stopers or drifting machines is much less than for the other methods described. In these first two methods, all that is necessary is to undercut the ore in the stope and drive one raise for supplies and ventilation at the extreme end of the block being prepared for mining. The section is then ready for the regular shrinkage method. When all the ore is drilled from below, large boulders are usually broken in the stopes to facilitate the drawing beneath. This leaves the large mass of broken ore in a much more workable condition than when large blasts are used. Also, much less secondary blasting on the grizzly level is necessary. This is the form of shrinkage most generally used—that is, where the men stand on the broken ore and carry up the stope by drilling with drifting or stoping machines. In all the other methods, considerably more preliminary development work is required. Where the drilling is done from branch raises, as described in No. 3, considerable work is involved in driving the parallel drifts and incline raises. In fact, where this method was tried out, ordinary shrinkage is preferred, but it has its use in ground which does not stand well when drilled from below.

Where No. 4 was used at Coronado a number of raises had already been driven to provide outlets for the ore mined in the upper levels; consequently a change to shrinkage did not involve a prohibitive development cost.

The example in No. 6 (Neihart, Mont.) has the advantage of being near enough to surface so that most of the ground can be broken with comparatively shallow churn-drill holes.

In Figs. 9 and 10 the ore is broken in large, coarse blocks in the primary blasting at a very low cost, but a considerable amount of breaking must later be done on the grizzly level.

Powder consumption with all these methods varies from almost 1 lb. per ton in the hard rock at Creighton, to 0.16 lb. per ton in the soft ore at Latouche. With the exception of Alaska Juneau, the stoping costs of all the methods approximate each other.

When the ore is broken in the usual narrow stopes with pillars between, by men working upward on the broken ore, the limits of the stoping area are under absolute control. On the other hand, when ore is broken with powder drifts or from raises with long, radial drill holes, there is no sharply defined boundary between broken ore and waste. Where the large powder blasts are used, compensation for this increased dilution is secured in the form of a much lower mining cost, but, in the other methods, as previously mentioned, the cost approximates that of ordinary shrinkage.

Naturally, where the larger percentage of the blasting must be done on the grizzly level, there is so much wear and tear in the finger raises leading down to the grizzly (as a result of blasting) that closely spaced draw points may not stand up, and longer intervals must be left.

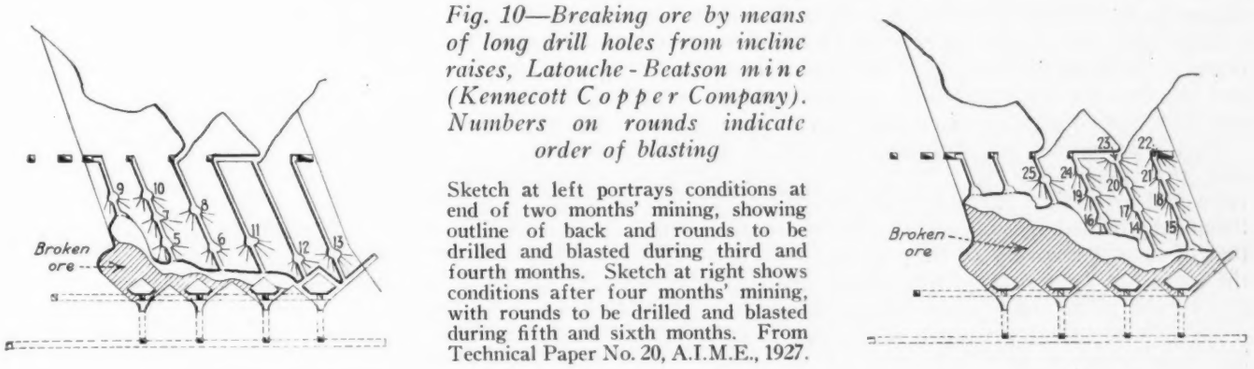
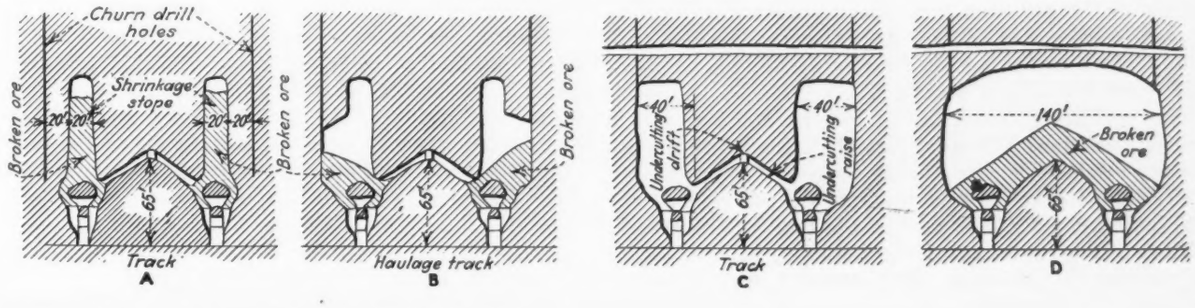


Fig. 10—Breaking ore by means of long drill holes from incline raises, Latouche-Beatson mine (Kennecott Copper Company). Numbers on rounds indicate order of blasting

Sketch at left portrays conditions at end of two months' mining, showing outline of back and rounds to be drilled and blasted during third and fourth months. Sketch at right shows conditions after four months' mining, with rounds to be drilled and blasted during fifth and sixth months. From Technical Paper No. 20, A.I.M.E., 1927.

[12] "Silver Dyke Property at Neihart, Montana," *Engineering and Mining Journal*, Feb. 5, 1927

Fig. 11—Method of breaking ground by means of churn-drill holes, employed at Neihart, Montana. From E.&M.J., Feb. 5, 1927



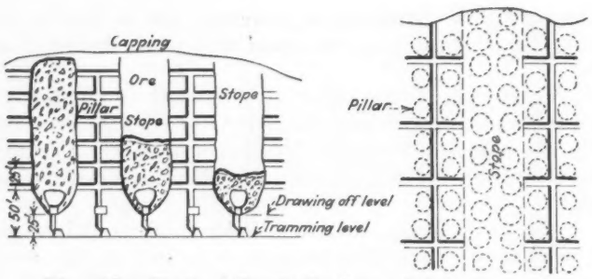


Fig. 12—Early Miami Copper shrinkage stopes. Left, Cross-section through stope pillars. Right, Plan of stope and pillars. Each raise served 312.5 sq.ft. From E.&M.J., Sept. 16, 1926, p. 496.

In straight shrinkage, the drawing-off chutes beneath the stopes are usually located on 15- to 25-ft. centers, whereas in the other methods of breaking the ore the chutes are frequently 40 to 75 ft. apart. It has been definitely proved that where caving methods are used on a large scale, the closer the spacing of the draw points beneath, the more even the draw, the better the recovery, and the less the dilution. This applies equally to the combined shrinkage and caving methods.

In the earlier Miami shrinkage stopes (50-ft. stope and 50-ft. pillar—see Fig. 12), where the stope ore was recovered by straight shrinkage and the pillars were systematically drilled, blasted, and caved, the records proved that of a total recovery of 95 per cent, the recovery of the stope ore by shrinkage was 10 per cent better than that of the pillar ore recovered through caving.

Straight shrinkage permits a little more selective mining than where a modified form of shrinkage, with wholesale drilling and blasting, is practiced. If a body of waste is encountered, large boulders of non-commercial material may frequently be left, and when these are finally drawn down to the chutes they may seal them and prevent the waste being drawn through.

Early practice in shrinkage was to use 50-ft. stopes and 50-ft. pillars. After thoroughly breaking up the pillar by drifting and raising, it was finally undercut and drawn simultaneously with the ore in the stope.

In recent years, however, narrow stopes and narrow pillars are more frequently used, such as the 15-ft. stope and the 10-ft. pillar. Practically no development work is done in these narrow pillars. They are merely undercut after the shrinkage stope has been carried up to the desired height, and the entire ore drawn down at a 60-deg. angle, so that the pillar becomes tilted and finally comes down immediately above the draw points, where it can be reached with long stoper steel and blasted.

The height to which it is practicable to carry shrinkage stopes depends largely on the type of deposit. If the vein is narrow (50 ft.) and flat-pitching (40 to 45 deg.) then it may not be practicable to carry the stope much over 50 to 75 ft. high, and some form of sublevel stoping must be used. The steeper the vein, the higher the stopes that can be carried to advantage. If stopes are very narrow (5 to 10 ft.), there is danger of ore hanging up when a lift of 100 ft. or over is taken. However, this difficulty can be overcome by careful supervision. In wide orebodies (400 to 500 ft.), shrinkage stopes may be carried up as high as 200 ft.

In general, ore should be drawn from shrinkage stopes each day, as this prevents the ore from packing and hanging up. The same difficulties are experienced with sticky ore in shrinkage stopes as are met with in the branch-raise caving methods. The best remedy is to keep the ore moving continuously. Under such circumstances, drawing on three shifts may be found advisable.

American Crystalline Graphite Production Increases

ALTHOUGH total production of graphite in the United States in 1927 was slightly less than that of 1926, its total value increased, according to a statement by the U. S. Bureau of Mines. The sales of natural graphite by producers in 1927 were 5,207 tons, valued at $232,971, a decrease of 263 tons, or 5 per cent, in quantity, and an increase of $13,629, or 6 per cent, in value, compared with 1926. The decrease in production was in the amorphous variety, the crystalline variety increasing both in quantity and value. The sales of amorphous and crystalline graphite were nearly equally divided, 2,595 tons of the former and 2,612 tons of the latter being sold or consumed by the producer. This was a decrease of 380 tons, or 13 per cent, in the former and an increase of 235,200 pounds (117+ short tons) or 5 per cent in the latter. The value of the amorphous variety decreased $4,650, or 11 per cent, and the crystalline variety increased in value $18,279, or 10 per cent, compared with 1926. The quantity and value of crystalline graphite in 1927 were the largest since 1920.

The producing states in 1927 were Alabama, California, Michigan, Montana, Nevada, Rhode Island, and Texas. Alabama is the leading state in the production of crystalline graphite and reported 66 per cent of the total quantity and 74 per cent of the total value in 1927.

The striking features of the industry, in 1927, were the activity in Alabama, the increased production of crystalline graphite there, and the reappearance of California as a producing state after five years of inactivity. The manufacture of artificial graphite in New York decreased considerably, from 21,163,986 pounds in 1926, to 12,257,239 in 1927, or 42 per cent.

The imports of graphite in 1927 amounted to 17,452 tons, valued at $723,923, compared with 16,166 tons, valued at $921,233 in 1926, an increase of 8 per cent in the quantity imported, but a decrease of 21 per cent in value.

Titanium in Bauxite Ores and Sludges

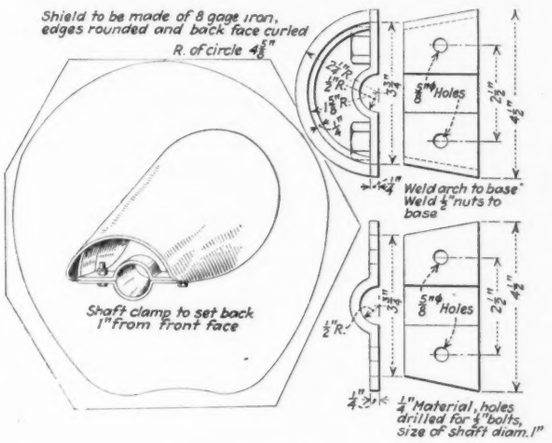
TITANIUM is a well-known component of bauxite ores, sometimes occurring in sufficient quantity to make its recovery worth considering. This question has been raised by some of the companies lixiviating bauxite ores. At the East St. Louis plant of the Aluminum Ore Company, a subsidiary of the Aluminum Company of America, the waste sludge discharged daily contains over 75,000 lb. of titanium oxide. The sludge is all through 20 mesh, and a large proportion is slime. In co-operative work between the U. S. Bureau of Mines and the Missouri School of Mines and Metallurgy, experiments were undertaken looking to the recovery of the titanium in this material, and a report, written by Will H. Coghill, is now available from the U. S. Bureau of Mines, Washington, D. C., giving the results so far achieved. Inquirers should ask for Reports of Investigations, Serial No. 2,867.

USEFUL OPERATING IDEAS

Hand Guard for Stoper Drills

IDEA No. 1

MC HENRY MOSIER, mine superintendent for the Phelps Dodge Corporation, at Morenci, Ariz., contributes the accompanying sketch of a hand guard for stoper drills. This guard, he says, was devised by E. E. Burgess, general development foreman at the Morenci branch. It is proving successful in preventing injuries to the hands of drill operators. The shield is made of 8-gage iron clamped on the drill handle.

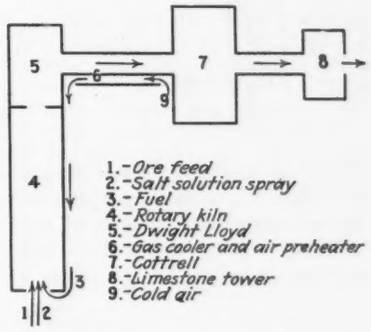

Shield to be made of 8 gage iron, edges rounded and back face curled
R. of circle 4⅜"
Holes
Weld arch to base
Weld ½" nuts to base
Shaft clamp to set back 1" from front face
Holes
¼" Material, holes drilled for ½" bolts, size of shaft diam.+"

A hand guard for stopers

Applying Chloride Volatilization in Practice

IDEA No. 2

THE PLANT arrangement such as that shown in the accompanying cut is suggested for the practical application of the chloride volatilization process by R. H. Bradford and C. M. Macfarlane in Technical Paper No. 3, issued jointly by the University of Utah and the U. S. Bureau of Mines. A rotary kiln is used to preheat the ore. The kiln is fired at the feed end and a solution of calcium or sodium chloride is sprayed into it at this end. The hot ore falls on the moving pallets of a Dwight-Lloyd sintering machine covered with a suitable heat-insulating hood. The gases from the kiln at 900 deg. C. are drawn through the charge of ore on the pallets. The mineral is chloridized, vaporized, and carried away along with the gases, through a cooling chamber where they travel through a heat-exchanger, countercurrent with fresh air for the furnace. Or the gases might be put through pipe stoves similar to those once used in blast-furnace operation, or through any suitable chamber in which they give up their heat to the incoming gases. At a temperature of 250 deg. C. they pass through the Cottrell precipitator, where the metallic



Plant arrangement for practical application of chloride volatilization process

chloride is precipitated. From the Cottrell they pass through a tower filled with limestone. The hydrochloric acid still remaining in them acts upon the limestone to form calcium chloride and carbon dioxide. A small spray at the top of the tower dissolves away the calcium chloride as it is formed, and the resulting solution is drawn off at the bottom of the tower and again sprayed into the furnace. The reduction furnace for the fume is arranged in the system as shown so that any chloride which might volatilize before being reduced could be caught again in the Cottrell, and any hydrochloric acid which might result from the hydrolysis of the chlorides could be caught in the limestone towers.

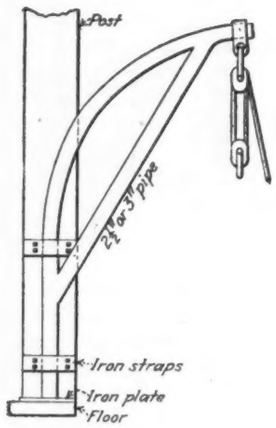
Results obtained would indicate that the rotary kiln is not necessary. In this case the cold ore could be fed to the Dwight-Lloyd, and a firebox or Dutch oven, necessary to insure complete combustion of the gases, would take the place of the kiln.

A Crane for Crushing Plants

IDEA No. 3

THE CRANE described in the following will be found convenient for handling heavy machinery in crushing plants, according to W. L. Home, in a recent issue of *Rock Products*. The instructions for building it are as follows: After determining where the hoist is to be located, cut a door in the side of the wall next to a solid post to which the frame may be attached. A permanent door may be put in and made to open outward when the hoist is to be used; at other times, the frame may be turned on the inside of the building and the door closed.

For the hoist frame 2½-or 3-in. extra heavy pipe, bent as shown in the sketch, is used. It is braced with another piece of similar pipe, which is welded to the curved piece. To get the maximum strength at the upper end of the pipe, a piece of shafting is welded on the inside. The blocks are attached by means of a band around the pipe. The frame is held in position against the post in the wall by means of two bands bent loosely around the pipe, so that the frame is free to turn. A piece of iron plate should be placed between the floor and the bottom of the



A handy crane for a crushing plant

frame to keep the pipe from cutting into the floor and to let it turn more easily. With this crane, loads up to 1,500 lb. or more may be hoisted up the side of the building without rubbing the walls. When it is hoisted, the load may be swung inside by swinging the frame.

Jack Used as Horizontal Press

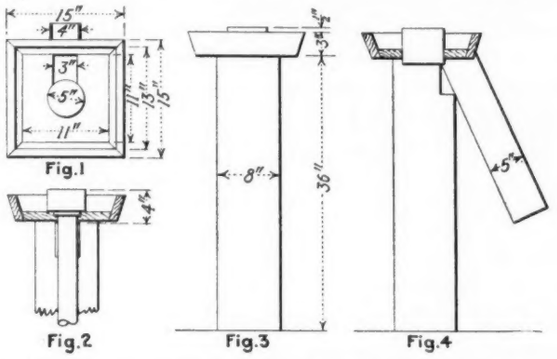
IDEA No. 4

A 7-TON hydraulic Blackhawk jack was used as a horizontal press for pressing in bushings in a mid-Western shop. This particular jack can be operated horizontally, provided the pump side is down. The shop work involved pressing collars to the end of drive shafts. To speed up production a spring was fastened to the base of the jack and to the side of the ram. When the release valve was opened by the operator, the spring pulled the head of the jack off the finished job, allowing the removal of the piece and the placing of a new shaft and collar. By the old method involving the mechanical press, the operator had to exert a heavy pull on an overhead handle to secure enough pressure.

An Anvil for Lead Buttons

IDEA No. 5

DETAILS of a slag anvil for use in the assay office in cleaning lead buttons are shown in the illustrations. The anvil is merely a beveled, square wooden tray, about 2 in. deep and lined with tin (pieces from a 5-gal. oil can), and set upon an 8x8-in. wooden post. In the center of the tray is a steel block, made



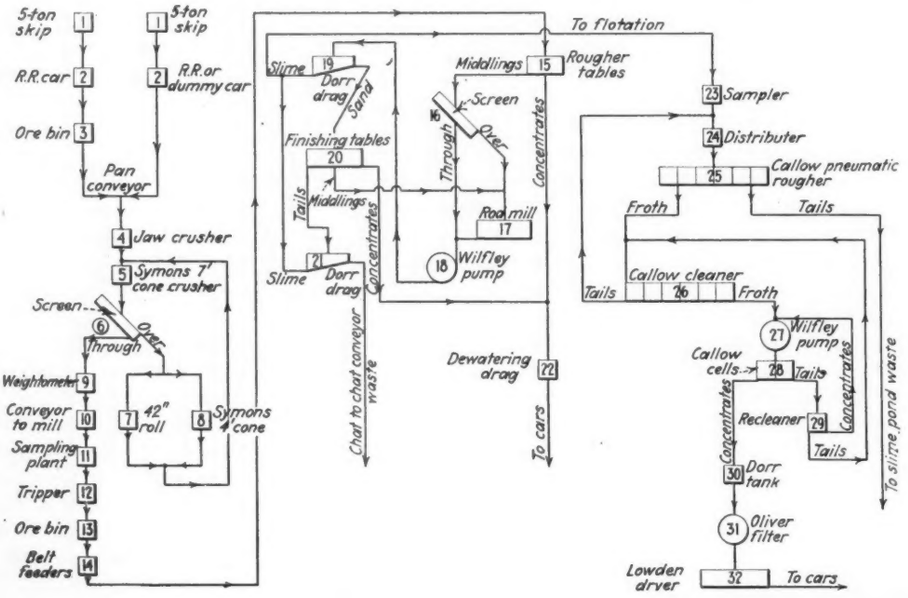
A laboratory anvil for removing slag from lead buttons

possibly from a section of shafting. This block is sunk into the post about ½ in. to insure stability.

Back of the steel block, a sheet-iron slide is fitted into the bottom of the tray for the purpose of providing a discharge for the discarded slag which drops into the tin trough, shown in Figs. 3 and 4, when the slide is opened. The trough conducts the slag through the side of the building or to any receptacle that may be provided.

Fig. 1 is a top view, showing the tray, the steel block, and the partly open slide. Fig. 3 is a front elevation; Fig. 2, a rear elevation with the side of the tray broken to show the slide mounted in the bottom of the tray and the trough; and Fig. 4 is a vertical section on the vertical median line of Fig. 1. The dimensions may be varied to suit conditions.

Flow Sheet of St. Louis Smelting and Refining Works, St. Francois, Mo.



COMMENT AND CRITICISM

Exposing Fallacy Fads

THE EDITOR:

Sir—Your editorial "The Rôle of Copper in Human Metabolism" suggests these mental and metallic inquiries:

Were our forbears wiser and healthier than we because "copper kittles" were commonly used?

And was the discovery (?) that they were a medium of unhealthiness merely propaganda for their replacement by iron utensils to supply the need (?) of that mineral in the human system?

More recent propaganda is replacing iron with aluminum in the kitchen. Again, perhaps, we will return to the metal of our forbears, following fashion changes of cookery containers.

For one I am heartily glad to greet the possible exposition of a fallacy fad.

Joplin, Mo. JESSE A. ZOOK.

* * *

Meeting the Need for Business in Engineering

THE EDITOR:

Sir—Students in mining engineering, geology, and metallurgy at the Harvard Engineering School have recently been granted the privilege of supplementing their work with certain courses in the Graduate School of Business Administration, ordinarily not available for undergraduates. The new combined course in engineering and business has certain advantages of rather unusual character, and the following facts concerning it may possibly be of interest to your readers.

Most engineers these days realize that business ability is as important as technical skill for advancement to high posts in the mining industry. Many have urged that more attention be given to instruction in economics and related subjects in the professional schools, but in the four years usually devoted to an engineering course there is little time for additional material except at the expense of essential technical training.

At Harvard, owing to the exceptional opportunities offered by the business school, engineering students, by extending their work to five years, may divide their time during the last two years between engineering and business subjects. Continuity between technical studies in the school and practical application in the field is not broken, as it would be if the business course were taken as graduate work following completion of the engineering course, and the student gains an adequate knowledge of the business aspects of his profession without weakening his interest in the technical department.

In the fourth year, courses in accounting principles, business statistics, and industrial management are substituted for part of the regular engineering work. In the fifth year, the remaining engineering courses are completed, with three business courses, including a general tie-together course called "Business Policy" and two others selected from a group, including industrial finance, traffic management, industrial accounting, international commercial relations, and statistics, as well. The business courses selected are for the most part of a general rather than a specialized character, and therefore well adapted to the needs of the engineer who may meet a wide variety of business situations in his work.

The need for a broad training of this nature may not be felt during the initial years of professional work, but a background of economic and business principles, not supplied by purely technical knowledge, becomes essential in later years, when larger executive responsibilities are assumed. Without the benefit of training, the technical graduate must accumulate his store of business facts and principles slowly, at a period when his mind is likely to be fully occupied with the technical intricacies of his direct engineering jobs. Undoubtedly, the exceptional man can do this, but the double load makes advancement slower and retards many keen men whose intense desire for the best results in their immediate problems keeps them from gaining the broader training necessary for advancement. This handicap suffered by engineers is indicated by their relatively small numbers among the leaders who are directing our greatest enterprises, even those based largely on engineering operations.

It should be within the power of the schools to give a man a training in power of analysis and a store of facts and fundamental principles that will enable him to see the significant aspects of new situations and to aid him in developing the business ability and judgment needed with his technical skill for success. With the additional training, at the cost of an extra year, a young man should be able to take more complete advantage of opportunities that come his way, and be prepared when the chance is given to him for promotion to places with responsibilities beyond those of purely engineering character.

I should be glad to furnish further details concerning the program of work, the specific engineering and business courses, and the requirements for entrance and degrees to anyone who is interested. The new combined course does not replace the usual four-year engineering course, but merely gives engineering students who are able to spend an extra year, the opportunity to include work at the Business School in their programs. The combined course leads to the degree of bachelor of science in engineering and business administration.

DONALD H. MCLAUGHLIN,
Professor of Mining Engineering.
Harvard University,
Cambridge, Mass.

* * *

Xanthates and Flotation

THE EDITOR:

Sir—The use of xanthates in flotation has been discussed so frequently in *Engineering and Mining Journal* that I should like to present a few economic facts concerning them.

As is well known, the xanthate of commerce is obtained by the reaction of potash with ethyl alcohol and carbon disulphide. In the same manner, various other alkali metal xanthates can be prepared, and from them the xanthates of other metals. This latter fact has been clearly recognized by those who have patented the use of heavy-metal xanthates.

Just as the metal part of a xanthate can be made to vary, so can its alcohol radical be altered. That is, potassium methyl xanthate, or potassium normal butyl xanthate, may be prepared, as well as potassium ethyl xanthate, by simply substituting methyl alcohol, or normal butyl alcohol, for ethyl alcohol. The practical value of the xanthates, other than ethyl xanthate, does not seem to be as well understood as it might be, even though the use of these xanthates has been covered by blanket patents.

Early in 1925, I prepared some impure xanthate from fusel oil, and discovered its superior collecting power. This has been fully demonstrated by recent systematic experimentation conducted in the laboratories of the Department of Mining and Metallurgical Research of the University of Utah.

It was believed formerly that the use of methyl xanthate (of which a larger amount is needed than of either ethyl xanthate or fusel oil xanthate) would result in better selection, and that the use of iso amyl (fusel oil) xanthate would give a poorer selection. This belief was not substantiated by experiments. In other words, iso amyl xanthate "does the trick" as well as

ethyl xanthate, and only one half to one quarter as much of it is required.

Experimental work on ores has been in agreement with the results achieved with pure minerals, not only better concentrates being obtained, but also a higher recovery of the sulphide minerals and, to some extent, also, of tarnished sulphide grains and of oxidized mineral grains.

The higher xanthates, such as butyl or amyl, should find favor, also, in oxidized ore flotation. As these reagents produce a faster, more mineralized, and coherent froth, the sulphidized grains from oxide ores can be removed as a froth before friction between grains in the pulp, or against the walls or parts of the flotation cell, has worn away the sulphide coating on the grains. This results in the saving of a large amount of mineral that would otherwise go into the tailing, or else require considerably more sulphidizing agent in order to be recovered. For instance, on an oxidized ore assaying 15.2 per cent lead, the tailing assay was reduced from 3.5 to 1.3 per cent, and the grade of the concentrate was increased from 55 to 58 per cent by replacing ethyl xanthate pound for pound with iso amyl xanthate.

Contrary to expectations, perhaps, the cost of sodium xanthate made from either fusel oil or butyl alcohol should not exceed that made from ethyl alcohol by more than 60 per cent. In other words, although costing 60 per cent more a pound, only one half to one quarter as much of the higher xanthates would be required, and metallurgical results would be considerably improved by their use.

I believe the above facts deserve the consideration of the operators in the mining industry who are employing flotation in the treatment of ores.

A. M. GAUDIN,
Associate Professor of Metallurgical Research, University of Utah.
Salt Lake City, Utah.

* * *

The Prospector Pleads for Backing

THE EDITOR:

Sir—I have a few pertinent remarks to make in regard to the article in *Engineering and Mining Journal* entitled "Southwest Seeks to Promote Increase in Mining Development." The answer is: Form a grubstake association such as Boulder County, Colo., has and advertise. You rarely see an article about mining in the daily papers. The average person never sees the mining papers unless he is interested in mining. The Los Angeles *Times* has a page or two on mining every Monday; also results of determination of samples sent in.

In regard to the organization of a Chamber of Mines in San Diego County: That is all well and good, but does it help the prospector or small mine owner? No! What is wanted is an association.

The old-time saloonkeeper was often the source of the prospector's grubstake, and has therefore contributed to the development of mining. Some of the old-timers are in the game yet. Numerous prospects are undeveloped because of lack of money to explore them. I am in that fix. You see your man. As soon as you mention "prospect," that settles it; low or high grade doesn't matter. They want a mine with thousands of tons of ore blocked out, big ledge, and high grade, preferably with a plant ready to start. Where does the prospector get off? But with an association back of him, the prospect can be opened up.

A vote of thanks to the fast vanishing prospector? We don't want thanks; we want transportation and beans and a reliable party or association to back us up.

I am sending you an old copy of the bylaws of the Boulder Grubstake Association; also an application blank. You can get a copy of the contract, and learn of the success achieved, by addressing L. E. Girard, Boulder, Colo. I have prospected for years and am going out as soon as I get another grubstake.

PHIL COOPER.

Los Angeles, Calif.

* * *

"Eye Sampling" and Its Merits

THE EDITOR:

Sir—I have read with unusual interest the article of Thomas T. Read in your issue of April 7 on ore sampling. Mr. Read's dice experiments are extremely interesting. He has gone to great pains to prove in a scientific and logical way that which all mine samplers learn in a hazy and indefinite way from actual experience—namely, that the average mine sample, taken in a purely mechanical manner, is very unreliable.

Mr. Read combines in his discussion, ore sampling and mine sampling. Perhaps I am an unusually dense reader, but it seemed to me that the distinction between the two problems might have been more sharply drawn.

In ore sampling the entire mass is crushed, and if one does not get a fair sample it is simply due to lack of mechanical diligence or intelligence.

In mine sampling the problem is vastly more complex, and I feel free to maintain that no system which is purely mechanical is at all adequate to the task.

In the first place, orebodies have complex physical forms. They may be more or less concentric, like a coconut; or they may be more or less cylindrical, like a log; or they may be more or less laminated, like a book; or they may be more or less spotted, like a raisin pudding; or they may have some other more complex form. No matter what general form the orebody follows, it may be not entirely true to form, and this possibility must be carried in mind along with other contingencies.

In sampling it is first essential to form an opinion as to the general form of orebody which is under consideration. If it is like a log, it is entirely obvious that a sample of a side exposure, consisting entirely of bark, would not be a fair sample of the entire log.

Many orebodies are more or less like flattened, knotty logs standing more or less vertically in the ground. Drifts may cut through knots—that is, rich places; or between knots—namely, lean places. Raises are likely to be located on rich streaks, particularly if the development work was done with a view to sale; but this is not always so. Sometimes raises are put up in lean places, so as not to waste the richer ore. Therefore it will be granted that no purely mechanical averaging of samples taken in drifts and raises will spell out an accurate average value of the ore in any given block.

The wise engineer will place his own valuation on the importance of each and every sample according to his idea as to whether it represents a cross-section, a lateral section, or some other section of an orebody.

Now, as to mechanical systems for taking samples: There are numbers of so-called infallible systems for taking fair average samples of orebodies. The two most used are the "random" system, which Mr. Read quite justly criticizes, and the channel system.

As a young man I traveled as assistant to a mining engineer who insisted that each sample must come from a neat little channel, cut to uniform depth, across the vein. He was very insistent that these trenches be made with great care and precision.

As a method of getting a fair sample, however, there is little that can be said in favor of the little groove or trench. Its one claim to accuracy rests on a condition which almost never exists—namely, a smooth surface to start with. Even then, orebodies are too spotted and erratic for a narrow, inflexible, mechanical system such as this.

Another prominent engineer with whom I traveled used to lay off a square and chip "at random" all over this square. Mr. Read has already pointed out the weakness of this plan.

After following mechanical systems for several years I gradually adopted a plan which all old samplers use more or less, but which I made somewhat novel by discarding all mechanical reliances. For want of a better name I will call this system "sampling with the trained eye," or "eye sampling" for short.

Every experienced engineer quickly recognizes certain salient characteristics in the ore of any mine he is called upon to sample. He does not know the exact relative value of the various salient characteristics, but he probably learns which are the rich streaks and which the lean, before he begins the actual work of sampling.

"Eye sampling" consists simply in comparing the sample with the exposure. Where a mechanical system is relied upon, the sample is generally tied up immediately after taking it, without comparing it at all with the face of ore it is supposed to represent. "Eye sampling" stresses the careful reviewing of the sample after it has been taken and comparing it with the spot it represents, and belittles the mechanical method of taking it. It is always well to take

large samples, which this method facilitates.

I started out using the trench system. When I first began to review my samples I was often startled by their obvious unfairness, although the corresponding trench looked as neat and fair as any one could wish. The trouble lay in the uneven surface one had to plow through.

As time went on I came to depend more and more on the review and less and less on the method of taking the sample, and as this change progressed my samples checked with ultimate shipments closer and closer.

The obvious objection to "eye sampling" is that everyone has not the "eye." An eye for a grade or an eye for shooting or an eye for art or an eye for sampling is not altogether the result of training. It is partly born in a man. However, I feel perfectly safe in stating that any engineer who makes a practice of comparing his sample with the face sampled will come much nearer checking with the shipment record than the engineer who does not do so. Hence I feel no hesitation whatever in recommending a fair trial of "eye sampling," particularly in hard-rock mines.

I also feel that I cannot lay too much stress in emphasizing the fact that every sample must be compounded into the ultimate conclusion not on any system of mathematical averages but on the opinion of the engineer as to what each sample represents with particular regard to its position in the oreshoot or orebody.

The engineer that throws out all abnormally high assays in order to impress his client with his conservatism arouses in me a feeling of disgust. Every sample means something, if properly taken. The high sample is as much entitled to the engineer's consideration as the low sample. Covering ignorance or inefficiency with a mantle of conservatism must be admitted to have been a good financial policy, judging by the record of the past. But is it a good policy today? I think not.

It seems to me that the day of the stupid but conservative engineer has gone by. The engineer with mechanical methods of sampling, rigid and stupid arithmetical methods of deducing conclusions from his samples, iron-bound notions about the relation between ore in sight and purchase price, could no doubt serve his clients well when capital was scarce and mines were plenty. The times have changed. Nowadays an ocean of capital is available, but good mines are hard to find. The conservative engineer today is the one who conserves the patience and research funds of his clients as well as their ultimate investments. To do this requires intelligent application and efficiency in every department of investigation. Sampling of mines is only one of many factors requiring intelligence and diligence.

The problem nowadays is not the selection of the best one from dozens of attractive mines, but it is the problem of finding for one's own financial backers a profitable mining enterprise in a much over-searched field.

To be successful one must get dependable results from every line of investigation and do it by the quickest and most economical means.

GEO. J. BANCROFT.

Denver, Colo.

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Geophysical Prospecting and Assessment Work

THE EDITOR:

Sir—We are all familiar with the growing interest in and importance of the various scientific methods of geophysical prospecting, to the engineering profession and to the mining industry. Their successful practical application to the development of new mines and new mining districts is too well authenticated to be subject of doubt. Their use by many of the larger companies is good proof that the expenditure of money for such purpose can be considered a wise disbursement in mine development.

Yet, because money expended in such manner cannot be applied to meet the requirements of assessment work on mining claims in the United States, the benefits of the methods are denied to many claim holders who might use them to great advantage. For who can deny that the intelligent application of such methods to the study of an undeveloped or partly developed group of claims would be much more beneficial, and give far greater impetus to mine development, than the expenditure of the same amount of money in the ordinary type of "assessment work"?

Canada has officially recognized the worth of electrical prospecting by making its use permissible in lieu of assessment work. Certainly, developments in Quebec and in Newfoundland, which have followed electrical prospecting, warrant this recognition.

Development and commercial application of the various geophysical methods of prospecting have been under the control of and sponsored by some of the foremost geologists and engineers in the profession. In the hands of concerns like the Swedish-American Prospecting Corporation, The Radiore Company, the Schlumberger Electrical Prospecting Methods, the Physical Exploration Company, the Geophysical Research Corporation, and the other companies listed in your issue of March 24, their use is free from any taint of quackery. Though they can never take the place of the geologist and mining engineer, they are becoming more and more useful and reliable tools, and in many cases may widely extend his field of usefulness. They have proved their right to a place of importance in the development of new mines and new mining districts. And to further the development of mines is the purpose of the requirement for annual labor on mining claims. Their benefits should not be denied to the many claim owners who, without outside assistance, are unable to do more than the assessment work legally necessary to maintain title.

The money spent annually in doing assessment work which is often of little or no real benefit to the property or to the owner, if used in the making of a scientific study of the property by these modern methods, should in many cases give the owner enough tangible proof of the possibilities of his property to enable him to enlist the capital necessary to its proper development. And only by the development of new mines can the metals essential to the national life be continuously supplied.

"Assessment work" seldom, if ever, has been responsible for the development of a producing mine, and, with the passing of the outcrops that were commercially valuable at or near surface, will do so less frequently in the future. If a similar expenditure for electrical prospecting should show evidences of strong sulphide mineralization not discernible at surface, as in many cases it has in practice, it may increase the appeal of a prospector's property to the mine investor more than many years of assessment work.

I have no connection nor financial interest in any of these processes, but when advising a client to have a survey made, if the money so spent could be applied as assessment work, we were told that in the absence of a Congressional ruling its use in such manner might endanger the title. In this particular instance I know that an expenditure for electrical prospecting would give results of much greater value to the property and to the owner than the same amount spent in "assessment work."

If a Congressional ruling is necessary to permit the application of money spent for geophysical prospecting for the requirements of annual work, it behooves all of us who are interested in mine development to work for the passage of such a ruling. And it should be presented as a matter of importance demanding early action on the part of Congress.

JOHN CARTER ANDERSON.

Beverly Hills, Calif.

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Sunnyside Mill Practice

THE EDITOR:

Sir—Noting Mr. Greene's communication in *E. & M. J.* of April 28, 1928, I wish to correct the statement relative to Sunnyside mill practice that "a middling, assaying about 20 per cent each in lead and zinc, was produced as a byproduct and could not be marketed." This statement is in error, as all lead-zinc middling made was returned to the lead circuit for re-treatment.

When I went to the Synnyside plant in January, 1923, I had the same impression that Mr. Greene has and took pains to investigate. At no time was a non-marketable lead-zinc middling produced as such and stocked. How the erroneous impression arose I do not know, unless it came from the fact that the Sunnyside operators were at one time experimenting with the idea of

subjecting a lead middling to a separate float in the hope of separating it into finished products.

Nevertheless, the facts are that the Sunnyside mill of U. S. Smelting, Refining & Mining, at Eureka, Colo., was operated on a tonnage basis in 1918, running on crude lead-zinc ore and making lead concentrates, sold to the A. S. & R., zinc concentrates shipped to retort smelters, and final tailings. No "byproduct middling" was ever made until 1924 or 1925.

R. A. PALLANCH,
Mill Supt., U. S. S. R. & M. Co.
Midvale, Utah.

Consultation

Iron-Ore Prices

"Are iron-ore prices estimated on the same basis today as in 1924? Apparently there has been some change in the method of estimating them. If so, what is it?"

Inquiry at the offices of the Lake Superior Iron Ore Association elicits the reply that the association has nothing to do with the matter of iron-ore prices. The secretary, W. L. Tinker, says, however, that, according to a book published by the M. A. Hanna Company, a change was made in 1925 in the method of calculating the base-unit value used in determining the value of ores of varying analyses from the base guarantee. In 1924 and prior years, the base-unit value was determined by adding 60c. to the Lake Erie base price and dividing this amount by the base guarantee. This 60c. was supposed to represent the average freight rate from Lake Erie ports to consuming districts, and this method was used for a great many years, with the idea of equalizing in some measure the long- and short-haul freight rates. In 1925 this practice was discontinued and in that year and since then the base-unit value has been determined simply by dividing the Lake Erie price by the base guarantee.

In 1925 also the base guarantee on Bessemer ores was reduced from 55 per cent to 51.50 per cent iron natural. This reduction in base was compensated for by changing the differentials in price. Prior to 1925 the Mesaba Bessemer price was 50c. above the Old Range Non-Bessemer and the Old Range Bessemer was 15c. higher than the Mesaba Bessemer. In 1925 and later years Mesaba Bessemer price has been the same as Old Range Non-Bessemer, and the Old Range Bessemer has been 15c. above the Mesaba Bessemer.

* * *

Characteristics of Molding Sands

"What are the principal characteristics of the materials known as molding sands?"

Several different materials are sold as molding sand for use in foundries for making molds and cores for casting metal. These vary considerably in chemical composition, in size and shape of grain, and uniformity. The type of sand required will depend upon the metal to be cast. In general, it may be said that molding sands are siliceous materials varying from loamy clay to clean silica sand. According to R. W. Stone, of the U. S. Geological Survey, they should be high in silica to be sufficiently refractory, should have a strong bond when moist, and should contain less than 1 per cent of iron oxide. Some sands lacking bond are tempered by adding a small amount of clay or other binder. The principal requisites of a molding sand are cohesiveness, refractoriness, texture, permeability, and durability. The sands used for iron works usually contain 75 to 85 per cent silica, 5 to 13 per cent alumina, less than 5 per cent of iron oxide, rarely more than 4 per cent of combined water, and usually less than 2½ per cent of lime and magnesia. The percentage of combined iron and lime may be higher if the sand is to be used for brass molding. The principal requirement of a core sand is permeability. A core sand, therefore, as a rule, should be high in silica and low in alumina, to prevent the fusing of the sand, which would stop the passage of gas or steam generated in casting. Commonly, core sands are made by mixing ingredients. The principal requirement of a steel sand is refractoriness, because the temperature of molten steel is considerably higher than that of molten iron or brass. To obtain the desired quality, it is necessary to use almost chemically pure silica sand. The grain of the sand will vary with the size of the casting and the smoothness of surface desired. According to Stone, molding sand in place possesses for the most part relatively little intrinsic value.

* * *

Market for Greensand, or Potash-Marl

"We have noticed, in the market section of *Engineering and Mining Journal,* price quotations of $25 per ton for greensand. Can you tell us just what this material analyzes, and what it is used for? We control a large deposit of glauconite-bearing material which we believe is similar to the greensand you quote."

Greensand, or potash-marl, occurs in large deposits in New Jersey. It is mined by the Marl Mining Corporation, Marlton, N. J. Potash-marl is a trade name given to this particular marl on account of the relatively high potash content, and to distinguish it from calcareous or lime marls. It is a direct and an indirect fertilizer, as it improves both the chemical and physical properties of the soil. It acts in conjunction with the elements to assist in unlocking plant food from the natural soil, in correcting acidity and promoting nitrification. The following analysis of greensand or potash-marl is reported from the government laboratories: Silica, 50.74 per cent; iron, 21.3 per cent; alumina, 6.52 per cent; potassium, 7.63 per cent; sodium, 1.53 per cent; lime, 2.86 per cent; magnesia, 3.76 per cent; sulphur, 0.88; and phosphoric acid, 1.79 per cent.

The Permutit Company operates a plant at Birmingham, N. J., to process greensand for water-softening purposes; the process is patented. Potash-marl is used as a soil builder and is a good dressing for lawns. As greensand is a natural product, the fertilizer laws of the various states do not apply to it any more than they do to lime, stable manures, and other products classified as natural. It is claimed that the use of greensand as a fertilizer imparts a characteristic color to foliage and flowers, because of the high content of combined iron and alumina.

By the Way

One Wahmonie Citizen in Clover

GOLD rushes in Nevada have been frequent recently, but they have not been as lucrative as once they were. However, Joseph D. O'Brien, of Wahmonie, latest mining metropolis, thinks the current boom conducive to material prosperity. Joseph, according to reports, has found paying ore. One of our contemporaries, published at Reno, goes so far as to credit him with making more money than anybody else in the state. And yet, Mr. O'Brien has not even scratched fair Wahmonie's expansive surface. Less prosperous citizens of this teeming city are compelled by stringent circumstance to wring from the stubborn desert their daily sustenance. Mr. O'Brien, on the other hand, waxes affluent without exposing his complexion to the tender mercies of the none too genial Nevadan sun. His prosperity may be directly attributed to the fact that he is absolutely unique. Not that we would imply that Joseph is in any way, physical or mental, a freak, for he is indeed a most accommodating and cordial gentleman. Rather it is his talent that makes him stand above the crowd. To be exact, Mr. O'Brien is a notary public. The law, that benevolent and powerful institution, requires that all mining claims be duly recorded with a notary public, and, what interests Mr. O'Brien far more, that that notary public be paid the honorarium of one silver dollar for each claim recorded. Taken by itself, a dollar, while worthy of some respect, is not entitled to too much consideration. When, however, investigation discloses the interesting fact that in less than a month there were fully 1,351 claims staked in Wahmonie, the more enviable side of Mr. O'Brien's profession becomes apparent.

INDUSTRIAL PROGRESS

The Equipment Review

SEVERAL new machines and devices having application in the mining and metallurgical industries have been announced recently, either through the official channels of the Patent Office or by manufacturing concerns. Possibly the most interesting of these is the metal-casting machine devised by H. C. Poske, of El Paso, Tex., and assigned to the American Smelting & Refining Company. It is shown in Fig. 1.

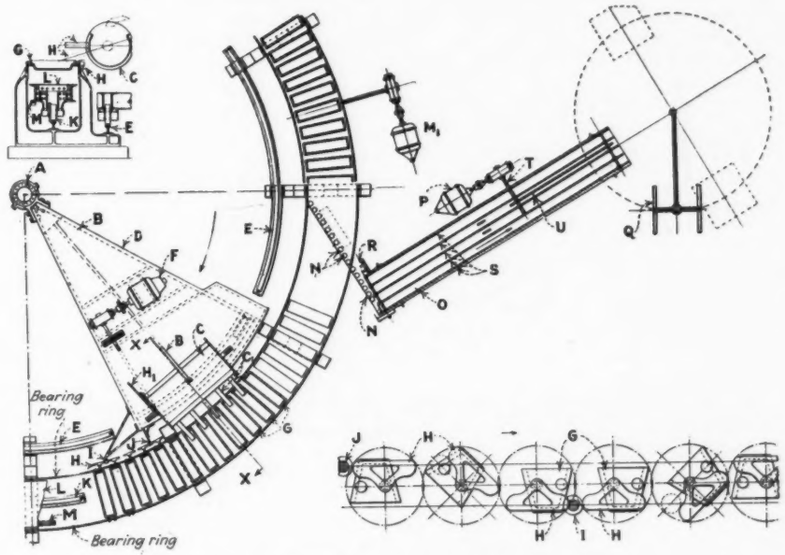


Fig. 1—Details of lead-casting machine

In casting with the machine, the molten metal, in this case lead, is delivered by the pipe, *A*, through a universal joint to a feed pipe, *B*, which in turn empties into the casting bowl, *C*. The bowl is mounted near the outer edge of the platform, *D*. This platform may be rotated about *A* as center and over the track, *E*, by a motor, *F*. Means are provided for tipping the bowl, thereby causing the lead to flow into the molds, *G*, through the pouring spouts, C_1. The molds are so supported that they may be dumped through the agency of a tilting shoe, *H*, on its engagement with the tilting members, *I* and *J*. The ingots thus dumped fall onto a table, *L*, which is driven by a rack and motor, *M* and M_1. The castings are discharged from the table by being wiped outwardly from it by means of rollers, *N*, onto the motor-driven conveyor belt, *O*, which carries them to the stacking machine, *Q*. As indicated in the sketch, the conveyor, *O*, is composed of several motor-driven endless chains, *S*.

In operation, the casting bowl is rotated with the table, *D*, so as to bring the pouring spouts over all the molds in turn. The castings are dumped from the molds after approximately a complete revolution of the pouring apparatus. Each mold, after having received the inverting impetus, is carried to the complete inverted position through the weight of mold and casting. The abrupt stopping of mold and casting by contact against the bearing rings causes the casting to be discharged.

Concentration

Mica Separation—The Chicago Mica Company, Valparaiso, Ind., has acquired the patent (U. S. No. 1,666,130) of Louis T. Frederick, covering a machine for splitting and separating mica. The intention of the designer was to provide a machine of large capacity compared with its size and one that will sort efficiently the desirable thin plates from the thicker pieces which require re-treatment. Fig. 2 shows the machine. It consists essentially of a revolving drum, *A*, into which the mica blocks coming from the mine are charged through the chute *I*. The blocks have previously been given a preliminary treatment consisting of bending alternately in opposite directions, to loosen the laminations. As the drum revolves, the blocks tumble over each other and are acted upon by the baffles, *F*, which action serves to loosen the flakes from each other. This action is enhanced by a blast of air that issues through the slot *P* in the center pipe. This blast may be dispensed with, if preferred. The slot *P* faces downward so that the air blast issuing from it strikes the edges of the slabs of mica as they rise under the action of the baffles of the rotating drum. The slabs or blocks requiring re-treatment fall into the receptacle *M*. A second current of air is blown into the drum through the duct, *J*. The separated flakes are blown out of the upper end of the drum by this current into the hopper *G*. Mr. Frederick claims that the combined effect of the treatment received in the drum effects a very complete separation of the flakes and also that the flakes are extremely thin and of considerable size—for example, 1x1 to 1x2 in.

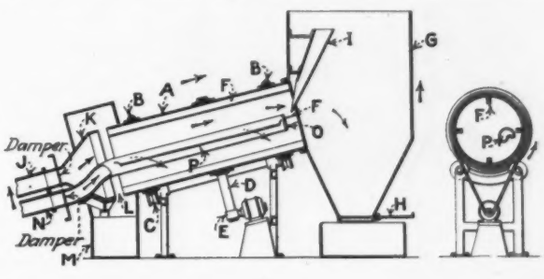
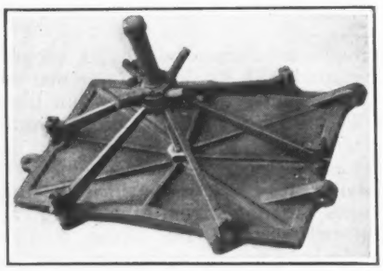


Fig. 2—Sketch showing a mica-separating machine

Leaching Plants

Manhole Cover—One of the accompanying photographs shows a manhole cover recently supplied by United Filters Corporation, Hazleton, Pa., to the Calumet & Hecla Consolidated. Covers such as these, it is said, are being used by the latter company on its ammonia stills. The feature of the cover is its quick opening. The clamping device has been used by the filter company for many years as a means of quickly clamping and unclamping the head of its Kelly pressure filter. It consists of a series of locking bars secured to a central collar and extending radially to the

edges of the door, where their ends are held in place by U-clamps. The collar is raised or lowered by turning the hand wheel which moves it along the threaded shaft mounted perpendicular to the center of the door. As the collar is lowered, the locking bars are forced outward through U-bolts in the still or other piece of equipment on which the door is used. The ends of the bars are



Manhole cover which closes tightly and opens quickly

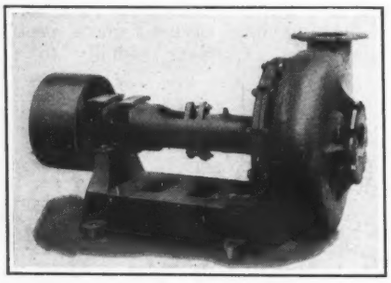
so formed that they also rise slightly, thus drawing the door tight against its seat. The leverage is such that considerable pressure can be obtained at the ends of the bars with very little pressure at the center. This insures a tight door for operation under pressure and at the same time one which is easily and quickly opened.

Laboratory

A testing sieve developed by the Newark Wire Cloth Company, 351 Verona Ave., Newark, N. J., has a round instead of a sharp corner on the inside. This facilitates cleaning. Moreover, the soldering is done on the outside. The wire cloth, when worn, can therefore be replaced by melting the old solder off and resoldering a new piece of cloth on, this without distortion of the cloth. These sieves come in 3-, 5-, 6-, 8-, 10-, and 12-in. diameters. They conform to the specifications of the U. S. Bureau of Standards.

Pumps

The illustration below shows a sand and gravel pump (Type I) made by the American Manganese Steel Company. This pump is said to be particularly adaptable to rehandling waste sand; also for conditions where abrasive action is high. It will work to heads up to 100 ft. and comes in sizes from $2\frac{1}{2}$ to 6 in. inclusive. Naturally, it is made of manganese steel.



A pump with manganese steel wearing parts

Recent Developments in Steam Generation

A Sketch by George T. Ladd

Concluding Instalment

The first part of this paper by Mr. Ladd, who is vice-chairman of the board of Combustion Engineering Corporation, appeared in last week's issue. In it he sketched the amazing advance made in steam-generation practice in the last decade. He continues as follows:

Recovery of Waste Heat

A large and increasing number of industries require furnaces for the heat treatment of material during manufacturing processes. These furnaces may be fired by coal (on mechanical stokers or in pulverized form), and by gas or oil. Usually, the heat treatment is such that the gases leave the cold end of the furnace at temperatures from 900 to 2,000 deg. F. The heat of these gases is commonly referred to as "waste heat," as they are discharged to the atmosphere, and the sensible heat which they contain, above the temperature of the outside air, is wasted.

Recovery of waste heat from industrial processes offers one of the most important opportunities for reducing operating costs. The idea of utilizing the heat of waste gases for steam generation is very old. However, the intelligent design and application of waste-heat boilers is comparatively new and dates from the first recognition of the fact that steam boilers for waste-heat reclamation present a problem of design and application that is entirely different from that given by steam boilers for direct firing. The gases from most waste-heat sources are at temperatures much lower than those of direct-fired boilers, and practically all of the heat must be transferred by convection.

Water Walls and Screens

The early large boiler installations had refractory furnaces. These had been used for years in spite of their known limitations, and it was quickly found out that some other form of furnace construction would be necessary. Air-cooled refractory walls were the next step. An air space, 9 to 12 in. wide, was left between the firebrick lining of the furnace and the outside wall. Air was circulated through this wall, heated, and the heated air admitted to the furnace. This was an improvement, but it was soon found that better results could be obtained by lining the walls with water tubes and putting water tubes at the bottom of the furnace to keep the ash below slagging temperature. Sometimes these tubes are connected into the boiler circulation and sometimes they have a circulation independent of the boiler. Such installations have now been in service long enough to demonstrate their usefulness for this work. The maintenance is less than with refractory walls, and they add to the heat-absorbing ability of the boiler. Last year, several steam generators were built and put into operation in which the furnace was entirely lined with water walls to take the maximum advantage of this construction. The results obtained indicate that there will be many more of these installations.

Air Preheaters

Economizers have been used for many years to recover heat in the waste gases discharged to the stack. They make for more efficient steam generation. The largest loss in the steam cycle has been and still is the heat absorbed by the condenser circulating water. In recent years this has been decreased by stage bleeding and by returning the condensed water to the boiler through a series of reheaters. The water in these reheaters is raised in temperature by steam bled from successive stages of the turbine, so that the feed water is nearly at the temperature of the boiler water. This makes an economizer uneconomical, and the air preheater has been designed to recover as much of this heat from waste gases as possible. The gases from the boiler pass through parallel passages in the air preheater, breaking up the streams into small lanes, and the incoming air passes through other parallel lanes, or across them in a direction counter to the current of the hot gases, so that the temperature of the air may be raised as much as possible. The low limit is the dew point of the escaping gases, which means that at the usual operating point of the boiler unit, their temperature will be 300 to 350 deg. F. The air is preheated to 450 to 600 deg. F. and is used for taking the moisture out of the coal before grinding in case of pulverized coal and is introduced into the furnace to assist combustion with both stokers and pulverized coal. This has made possible an over-all efficiency of 88 to 89 per cent with steam generator units operating at high ratings. When this is compared with 70 per cent efficiency, customary up to five and six years ago, it can be readily seen what has happened to our coal mines.

It is interesting to note that most of the hydro-electric systems have built or are building steam plants to supplement their water powers. Many of these corporations are now installing steam plants that will produce electric current at a less cost than they can secure it from extensions to their hydro plants.

With such things being done today, it would be a bold man who would make any predictions as to probable developments even within the next few years.

The high-pressure units make it possible to bring the present 250- to 400-lb. plants up to date by giving increased

capacity and greater over-all efficiency. As the exhaust steam turbine bridged the transition from engines to turbines, so the superimposing of high-pressure units will bridge the transition of low-pressure power houses to high-pressure ones. When we consider the industrial plant using steam for process work, the high-pressure turbine offers still greater possibilities. By raising the steam pressure to 800 lb. or 1,400 lb. and using the turbine as a reducing valve, electricity can be put at the switchboard for one-third of a pound of coal per kilowatt, and the steam is then available for its usual work.

Low-Temperature Distillation

The fact that coal heated to about 1,000 deg. F. gives up most of its volatile gases from which benzol, gas, tar, and hundreds of other byproducts may be obtained, and leaves a coke, has been known for many years, and millions of dollars have been spent in experimental plants to recover these by-products before using the coal for fuel. The coke produced is not a metallurgical coke, and the uses to which it could be put have had a limited application.

A system in which the coal is pulverized before being heated, and the resultant coke is ready to fire under boilers in a pulverized form, has been in operation for over a year in Milwaukee and has proceeded far enough to warrant the statement that it will succeed. Another system in which the resultant coke offers a successful domestic fuel has been in commercial operation at Essen, Germany, since 1924, and a similar plant is now being erected at New Brunswick, N. J. For steel plant work, it is suggested such a system would replace the present producer plants, the resultant coke would be used to make water gas, and the gases obtained from these processes would be used to mix with blast-furnace gas and coke-oven gas to produce a gas that would give maximum results in the plant. This business is in its infancy, and has proceeded far enough to indicate that its growth will be rapid from now on.

Dry Quenching of Coke

Metallurgical coke has customarily been quenched by water. By this method, the sensible heat in the coke is lost. The water splits the coke, lessening the amount of large-sized material. The coke contains a large percentage of moisture.

In Europe there are twelve installations, and in the United States one, in which the coke is introduced into a furnace, and a fan circulates an inert gas through the coke and over a waste-heat boiler. The coke is reduced to about 350 deg. F., and from 650 to 900 lb. of saturated steam is produced per ton of coke dry quenched. Such coke is superior to the water-quenched kind, and the heat is put to a useful purpose. The operation, moreover, is automatic, thus releasing men for other work. Heat may be recovered from cement clinker in a similar way.

INDUSTRIAL NOTES

The Columbus McKinnon Chain Company, Tonawanda, N. Y., has purchased the chain block electric hoist and crane division of the Chisholm-Moore Manufacturing Company, Cleveland. S. H. Moore, president and founder of the Chisholm company, will continue active. Sales offices and plant will remain in Cleveland. They will be operated as the Chisholm-Moore Hoist Company.

Howard J. Griffin, formerly sales manager for the Spencer Construction Company, of Baltimore, and for some years with Allis-Chalmers, in the East, has joined the sales organization of the Chain Belt Company, Milwaukee. He will be connected with the chain and engineering division, which includes the Stearns belt conveyor line.

The Roller Bearing Company of America, Newark, N. J., has purchased the plant of the Mercer Motor Car Company at Trenton, and will transfer its present equipment to it. Additional machinery will be installed.

Southwestern Engineering Corporation and the Radiore Company have moved their New York office to the Roebling Building, 117 Liberty St.

Theodore Beran, commercial vice-president of the General Electric Company and in charge of the New York district since 1903, has retired.

The Wagner Electric Corporation has moved its New York sales office from 50 Church St. to 30 Church St. Its local service station will remain at 321 West 54th St.

The Vanadium Corporation of America has announced the appointment of Ward A. Miller as vice-president. He will be located at the New York office at 120 Broadway and will supervise the company's commercial affairs. N. Petinot, formerly general manager of sales, is now assistant to the president and will devote his time to technical matters. Jerome Strauss, formerly with the U. S. Naval Gun Factory at Washington, has been engaged for special engineering and metallurgical work.

The Institute of Makers of Explosives, 103 Park Ave., New York, calls attention to the fact that in the last year 500 million pounds of explosives was transported by rail without loss of life or personal injury. Money loss was confined to $45. Fireworks were responsible.

Robert W. Baird, Milwaukee banker, has been made a director of the Chain Belt Company to fill the vacancy caused by the death of H. O. Seymour.

L. A. Bassett, president of the Hendrick Manufacturing Company, Carbondale, Pa., is back in his office after four months' absence in the West.

W. H. Post has been made manager of the Pittsburgh office of the Timken Roller Bearing Service & Sales Company.

The Linde Air Products Company has opened a new sales office at 48 West McLemore Avenue, Memphis, Tenn., with H. N. Smith in charge.

Crossle, Scott and Duff, Pty., Ltd., Collins House, Melbourne, Australia, have been appointed agents for the Dorr Company in Australia and New Zealand. Mr. Scott will be in charge of mining and metallurgical interests and Mr. Duff of sanitary engineering and water treatment work.

PATENTS

FILTER. No. 1,668,557. May 8, 1928. Gustaf Gröndal, Djursholm, Sweden.

The illustration in the "Official Gazette" shows a machine comprising a spider with eight rotating arms and with twelve separate tiltable filtering receptacles mounted at the periphery. These are connected with compressed air and suction so as to permit the performance of the filtering cycle. The receptacles are filled with pulp at one point of the circumferential travel, and the cake, on completion of the cycle, is discharged at another point through the tilting of the receptacle.

WELDING, ELECTRIC. No. 1,668,783. May 8, 1928. W. E. Rupley, assignor to Western Pipe & Steel Company of California, San Francisco.

APPARATUS FOR EXTRACTING OIL FROM SHALE. No. 1,668,820. May 8, 1928. William Rhoades, San Leandro, Calif., assignor to Rhoades Shale Oil Company.

FLOTATION, FROTH. No. 1,668,917. May 8, 1928. C. P. Lewis, assignor to Minerals Separation North American Corporation.

This covers the process of concentrating oxidized ores by agitating the pulp with xanthate and a soluble silicate under such conditions that mineral-bearing froth is produced, and separating the froth.

ROCK DRILL. Nos. 1,669,002 and 1,669,004. May 8, 1928. J. J. Grant, Vancouver, B. C.

INDUCTION FURNACE. No. 1,669,109. May 8, 1928. James M. Weed, assignor to General Electric Company.

AIR-LINE OILER. No. 1,669,375. May 8, 1928. Gideon Ihrmark, assignor to Ingersoll-Rand Company, New York.

BULLETINS

PUMPS—Aldrich Pump Company, Allentown, Pa. Data 57. Kosmos porcelain plungers. Four pages.

FUSES—Trico Fuse Manufacturing Company, Milwaukee. Bulletin 206-B. Powder-packed renewable fuses.

GASOLINE-KEROSENE ENGINES—Fuller & Johnson Manufacturing Company, Madison, Wis. Bulletin 710. Model NC industrial engines, 1½, 2 and 2½ hp. Four pages.

MINERALS—Julius Bohm, Nibelungengasse 3, Vienna, Austria. Price catalog of 72 pages.

FILING MAPS AND PLANS—The Globe-Wernicke Company, Cincinnati. Pamphlet, 24 pages. A system for filing and indexing maps, plans, drawings, and other large sheets.

RECORDING GAGES—The Bristol Company, Waterbury, Conn. Catalog 1800. Recording liquid level gages, comprising 32 pages.

AUTOMATIC CONTROL—Monitor Controller Company, Baltimore, Md. Bulletin 110. Twenty pages.

PUMPS—De Laval Steam Turbine Company, Trenton, N. J. Pamphlet E-1118. Eight pages.

UNIT HEATER—Bayley Blower Company, Milwaukee, Wis. Bulletin entitled "Cold Facts on a Hot Subject." Eight pages.

BELT DRESSING—E. F. Houghton & Company, Philadelphia. A 12-page booklet entitled "Belt-Dressing Facts."

NEWS OF THE WEEK

Summary

MOUNT ISA reserves are estimated at 5,000,000 tons above the 200 level and 3,000,000 tons for every 100 ft. below by L. Urquhart, chairman of Russo-Asiatic. Program of construction at this Australian silver-lead discovery is outlined. Page 868.

* * *

Shipment of three dredges to Fairbanks by U. S. Smelting, Refining & Mining is taken as a forecast of the revival of that district. Page 867.

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Stockton Hill, a lead-zinc-silver property near Kingman, Ariz., is being actively developed by Old Colony Mines. This mine formerly belonged to Comstock Silver, but was shut down because of lack of water. Page 867.

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The March output from the Kalgoorlie gold field, in Western Australia, was the lowest in years. New metallurgical developments at Wiluna Gold and activity at Sons of Gwalia are the hopes of the local industry. Page 871.

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Discovery at Denn mine of Shattuck Denn may prove to be another important orebody in Bisbee district. Drift at 2,000 level indicates extensive sulphide orebody. Page 870.

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Frank B. Powell reports that several rich deposits of tin in Nigeria have yet to be exploited, thus dispelling fears of exhaustion of that field. Page 871.

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Nichols Copper will probably build its new refinery at Houston or El Paso. Page 866.

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New strikes of high-grade ore are reported at the Abana and Noranda mines in the Rouyn district, Quebec. Construction work is progressing at Waite-Montgomery. Page 868.

House of Representatives Passes Winter Bill for Potash Research

By Paul Wooton

Special Washington Correspondent

WASHINGTON, D. C. MAY 22.—The House of Representatives yesterday passed the Winter bill, authorizing an expenditure of $100,000 for the next fiscal year and $50,000 for the succeeding three years for research and experimental work on the leucite deposits of Wyoming. The bill now goes to the Senate for further action.

On May 3, the Committee on Mines and Mining of the House reported favorably on the bill, introduced by Representative Winter, of Wyoming, which provides for "chemical, engineering, and manufacturing research, and employing clerical and technical assistants to determine more improved methods and cheaper processes for recovering potash from the leucite, alunite, and other potash-bearing deposits in the United States." It was pointed out at the time by the committee that the polyhalite deposits of Texas and New Mexico, recently drilled by the government, were not pure and that they had to be subjected to study and experiment to devise a method that would make the treatment of them profitable.

The deposits in Wyoming run from 10 to 12 per cent potash and 10 to 12 per cent alumina, with silica and other byproducts,. It is believed that if a cheaper process can be found for the extraction of potash from these deposits, and also from the alunite beds in Utah, the United States could be made absolutely independent of foreign sources of supply in case of war or other emergency.

Aërial Mapping of Northern Alberta Will Begin Soon

UNDER the direction of the Dominion Topographical Surveys Department, aërial surveys of northern Alberta will be started this summer. A program which it is expected will take three or four years is being initiated. One or more flying machines, fully manned and outfitted for the work, will be employed, starting in the vicinity of Lake Athabaska. Complete photographic and topographic surveys of the area, which is part of the Pre-Cambrian shield, will be made.

Since 1922, when aërial mapping was first undertaken in Canada, a total of more than 200,000 square miles has been photographed by the Royal Canadian Air Force, in co-operation with the Topographical Survey. During 1927 the Topographical Survey received 117,424 photographs, 70,421 of which were for record and mapping, and 47,003 for constructing mosaics, for surveyors in the field, and for distribution among provincial officials, city engineers, mining and lumbering corporations, and the general public.

The following sheets of the Topographic Map of Canada were completed during 1927 from photographs obtained in the previous year: Rouyn Lake sheet and Rouyn-Larder Lake sheet, on the two-mile scale; Dubuisson sheet, on the one-mile scale; and The Pas, Grand Rapids, Cormorant, Herb Lake, Trout Lake, and Sioux Lookout, on the four-mile scale.

New Copper Refinery to Be at Houston or El Paso

EITHER Houston or El Paso is likely to be the site of the new refinery to be built by the Nichols Copper Company, and construction of which is expected to start this fall. Houston provides, through its ship canal, ocean shipping facilities, but El Paso has compensating advantages. No decision has yet been reached as to whether the series or multiple system will be used; the first named is being seriously considered, as the company has made much technical progress in the use of this method at its Laurel Hill plant. A. E. Wheeler, who is now in Russia, is consulting engineer on the work, and preliminary sketches have already been drawn up. Final decision on the marketing organization of the Nichols-Calumet & Arizona-Phelps Dodge group has not yet been made, but it is expected that representatives of each company will be on the selling board. New offices will be opened at 99 John St., the present Phelps Dodge headquarters.

New Dredges Forecast the Revival of Mining in Fairbanks Field

FAIRBANKS, Alaska, is coming back as a producer of gold. U. S. Smelting, Refining & Mining has shipped two huge dredges, which are now being erected and which will be ready to begin digging about the middle of August, according to company officials. A third dredge is on the way. Also, a power plant and ditch lines are ready for the 1928 season.

Preparations for the large-scale working of the gravels in the Fairbanks region have been going on for two or three years, according to George C. Dickens, of the Alaska Railroad. It is a huge undertaking, on which $10,000,000 was spent before any production began. An incident of the development of the plans was the construction of a canal, 100 miles long, to carry water for the operations.

Cost of transporting heavy machinery to so isolated a community has been great. Auto trucks have been introduced and roads built upon which they might operate. All of the necessary materials and supplies have come over the Alaska Railroad. It was largely because of them that this road was brought, in December of last year, to yield the first profit it has known since it was built.

The town of Fairbanks, which in boom times boasted 20,000 inhabitants, had run down to 2,000 before this activity began. Already it has shown a revival that has brought its population up to 4,000. When the plan for large-scale gravel washing becomes fully operative the population of Fairbanks will doubtless be still further increased. This operation promises to last 25 years before the known gravel beds are exhausted and it is expected to lead to the development of other possibilities of the region. There will, for instance, be a call for greater agricultural production which only waits the development of a market, and there are many quartz mining possibilities in the region that may be developed. The government sees a brighter prospect for interior Alaska and the government-owned railroad than has presented itself for a long time.

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American Potash to Sink a Shaft at Odessa, Tex.

ACCORDING to Max Agress, president of the company, American Potash will spend about $2,000,000 in constructing a potash refinery, sinking a shaft, and installing mining equipment at its potash deposit, situated 10 miles south of Odessa, Ector County, Tex. Mr. Agress says that the refinery, which it is expected will be constructed within the next twelve months, will have a capacity of 2,000 tons daily. The company was recently incorporated with a stock of 10,000,000 shares of no par value.

Government and private explorations of the potash beds in the district are reported to be meeting with satisfactory results. Information has been received of the discovery of a 50-ft. bed of potash in drilling for oil on the Connell ranch, 10 miles west of Odessa.

Production of potash on a commercial scale will be under way in the Odessa section within twelve months, according to report. The potash lakes of Terry and Lynn counties in the south plains of Texas also are to be exploited.

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Several Washington Mines Resume Operations

AFTER being closed down for a year, as a result of the drop in the price of copper, the Admiral mine of Admiral Consolidated Mining has resumed operations. The holdings of the company total 420 acres near Valley, Stevens County, Wash. The mine has been developed by six tunnels, totaling 4,000 ft. in length, and by a shaft sunk to a depth of 200 ft. Equipment on the property includes a 40-hp. steam plant, hoist, and Sullivan compressor.

Ark Mines, in the same district, is also resuming operations for the summer. The mine, which is known as the Silver Queen, carries a silver-copper ore. According to J. J. Budd, president and manager, machinery will be repaired before development is continued. The company is financed largely by local interests.

Development at the American mine, northeast of Colville, Wash., is progressing rapidly, according to C. A. Noll, president of the company. Two tunnels have been driven on the property. A strike of silver-lead-zinc ore, said to be 18 ft. wide, is reported on the upper level.

Copperton—The model town of the employees of Utah Copper near Bingham, Utah

Utah Copper Adds to Model Mining Town

CONSTRUCTION of twenty more homes at Copperton — the model town at the mouth of Bingham Canyon for employees of the Utah Copper Company—was begun this month. These homes, which will represent an average cost of $5,000, or an aggregate expenditure of $100,000, will bring the total number of residences in the settlement to 63. As described in a special article that appeared in the March 3 issue of *Engineering and Mining Journal*, the houses are attractive, exceptionally well built, and modern in every respect. They have copper-clad strip shingle roofs and numerous other features in which the metal has been economically and efficiently utilized.

In the accompanying illustration of Copperton, the playground, tennis courts, ball park, and automobile parking section are seen on the right; a community park is in the center; and the residences are to the left.

Old Colony Is Developing Its Stockton Hill Property

OLD COLONY Mines, Ltd., a Canadian corporation, has started work on a development program at its Stockton Hill property, near Kingman, Ariz. The old Stockton Hill tunnel is being cleaned out and repaired, and will be driven further on the Prince George vein, on the strike of which it lies. The elevation of the portal is 4,200 ft. The tunnel is 1,500 ft. below the highest outcrop on the property. Another tunnel is being driven at the 4,400-ft. elevation, and two others will be started at 4,600 ft. and 4,800 ft., respectively. As the tunnels are carried into the hill, they will be connected by raises. A compressor is being installed, and air lines are being laid to the portals of the tunnels.

Until recently the property was operated by Comstock Silver, of which F. H. Manson was manager. In 1926 it was estimated that this company had opened ore reserves of 300,000 tons of lead-zinc-silver ore. At the time a considerable tonnage of shipping-grade ore was sent to the railroad, 12 miles distant. A 25-ton capacity pilot mill was built and operated until late in 1927, when lack of water necessitated a shutdown. At this time Mr. Manson interested Old Colony in the property, and that company, after a careful examination, appropriated enough money to develop it as outlined above.

The Diana mine, in the same district, is being unwatered by the Magma (Arizona) company. The mine is developed by a 300-ft. two-compartment shaft. When unwatering is completed, lateral development work will be started on the 300 level. The same company is driving a drift on the 100 level of the Washington Extension property.

Mount Isa Reserves Are Put at 5,000,000 Tons Above 200 Level

Sulphide Orebody Below Is Estimated to Contain 3,000,000 Tons of Silver-Lead Ore for Every 100 Ft. of Depth

THE immense reserves of both oxidized and sulphide lead-zinc-silver ores at Mount Isa, in Australia, which are being developed by Russo-Asiatic Consolidated, Ltd., were dwelt upon at some length by Leslie Urquhart at the recent general meeting of the company in London. Over 5,000,000 tons of carbonate ore containing 8 per cent lead and 2 oz. silver has been developed, down to the 200 level, below which the sulphide orebody amounts to 3,000,000 tons per 100 ft. of depth, containing about the same amounts of lead and silver, but with a zinc content somewhat higher than the lead. This has been proved to a depth of 600 ft., with diamond drilling below this level now in progress. The mine, which is known as the Black Star, is said to be one of the greatest lead-zinc deposits ever discovered. Exploration of the area is being carried on intensively, but it will be a long time before a definite idea of the extent of the ore deposits is obtained.

It is the policy of the Mount Isa company to begin operations with a plant designed to treat 2,000 tons daily of carbonate ores in the proportion of about 1,500 tons of lower-grade and 500 tons of higher-grade, to smelt the concentrate on the ground and to ship only silver-bearing lead bullion.

The program provides for completion of the first section of the mill of 500 tons' daily capacity by the end of the summer of next year, increasing to 2,000 tons a day by June, 1930. Estimates prepared by the company's engineers on the spot show that with lead at £20 per long ton, Mount Isa, by the end of the summer of next year, should be earning profits at the rate of £220,000 per annum, increasing by June, 1930, to £570,000 per annum. These estimates are based on lead production alone and do not include zinc. The beneficiation of the zinc product to the best advantage is a problem which is receiving attention, but in the event that electrolytic treatment of the zinc concentrate should be decided upon, the inclusion of the zinc product will, at present metal prices, increase the rate of profit per 2,000 tons a day mill capacity to around £800,000 per annum.

Discuss Fraud in the Sale of Mining Securities

THE San Francisco section of the A.I.M.E. discussed the California Corporate Securities act at its meeting on May 8, 1928. Howard C. Ellis, of the California State Corporation Department, stated that the object of the law was to prevent fraud in the sale of securities. Many operators resent the fact that they are under supervision or regulation. The Corporate Securities act is a branch of the police power of the state and is not intended to obstruct or harass legitimate enterprise. The policy is to favor mining and oil companies. Some types of promotion require no supervision, but, as all applications for permits are required to conform to the established regulations, no discrimination is made.

Mr. Ellis said that the out-and-out promoter is a menace; that the enthusiastic promoter, not dishonest, but believing that he has a million or two in the ground, is the hardest man to deal with. He called attention to the need for adequate engineering reports and the difficulties arising from the large fees demanded by mining engineers for their services. Characterizing Weepah as a typical swindling boom, he placed the blame for promoting poor stocks upon the "mining fraternity." Out of some 1,200 mining companies that had licensed permits to sell stocks, over 1,000 had died a natural death, but their stocks were still being peddled. He gave a number of examples of frauds. In conclusion, he stated that the Corporate Securities law needed additional teeth.

L. C. Wyman, engineer for the Corporation Department, said that the department required a report from an engineer of recognized standing. The report should include a legal description of the property and its location, description of transportation, power and water facilities; history of the property, maps, description of neighboring mines, estimate of ore in sight and sampling results, and justification for the price asked for the property. He stated that the principal reason for the decline in mining is that property owners hold out for excessive prices or excessive payments.

Judge John F. Davis reviewed the history of the Corporate Securities law and pointed out some of its significant features. He commended the work of the Corporation Department and stated that it needs a fighting lawyer force to make it more effective.

Argonaut Files Dismissal of Its Suit Against Kennedy

Argonaut Mining, recently defendant in a damage suit by Kennedy Mining & Milling, filed a dismissal of its action for $800,000 damages against the latter company on May 14. This action was a counter suit against the Kennedy, which lost its suit against Argonaut for damages resulting from the disastrous Argonaut fire of 1919.

Activity in Colorado Mines Is Continued

THE Veta Madre, Gerry-Owen, Richmond, and Sterling mines, located on Galena Mountain near Silverton, are being operated by C. M. Lane. The mill is being put into condition to treat lead-zinc ore.

A strike of gold-silver ore is reported by the Quinn-Wallace Mining Company, operating near Monte Vista, Rio Grande County. The new strike is in the vicinity of the Bob Lee mine, which was recently reopened by Valley Mining & Milling.

Falcon Lead, which owns properties near Rico, Colo., has increased the number of men employed to develop the orebody recently found in Nora Lilley tunnel. The portal of the Fortune tunnel has been retimbered, and the company has acquired the Louis Larsen properties on Silver Creek.

The Fairview mine of United Gold Mines, on Iron Clad Hill, in the Cripple Creek district, has resumed shipments after being shut down during the winter. Mineralization is in gold with a little silver.

Vindicator shaft of United Gold, in the same district, is being operated to full capacity, more than 100 tons of ore being shipped daily. The company is operating a crushing mill.

Noranda and Abana Report Strikes of High-Grade Ore

AT THE Abana, in the Rouyn district of Quebec, diamond drilling on the east side of the diabase dike has encountered a copper-zinc orebody, said to be high grade and averaging 30 ft. in width. This discovery constitutes a substantial addition to the ore reserves, on the west side of the dike, which have been officially valued at about $8,000,000.

J. Y. Murdoch, president of Noranda, announces that high-grade ore has been encountered in the shaft at a depth of 980 ft. The orebody has been opened up for 18 ft. Assays are not available, but the grade is sufficiently high to justify shipping the ore directly to the smelter. Contracts are being let by the company for waste-heat boilers for the second smelter unit.

It has been decided to sink an additional 150 ft. at the Waite-Montgomery. The steel for the new 500-ton concentrator has arrived and construction is proceeding.

Kassan Gold Applies for Permission to Build Dam

Kassan Gold Company, of Seattle, has applied for a preliminary permit covering a development on the east side of Prince of Wales Island, Alaska. The company, which operates a mine on the island, proposes to construct a dam at the outlet of Little Salmon Lake, providing 10,000 acre-feet of storage. A transmission line, 10 miles long, is planned from the development to the mine.

New Quincy Mining 60 Tons Silver-Lead-Zinc Ore Daily

DURING the last ninety days, the New Quincy mine, situated in the Park City mining district of Utah, has steadily increased its production, the current rate of output being 60 tons a day of silver-lead-zinc ore carrying some gold and copper. Development of the property, which comprises 138 acres, has been in progress for the last two years, and, according to A. L. Hurley, general manager of New Quincy Mining, this work has recently encountered several additional mineralized fissures, which are being followed to a common point of intersection about 600 ft. west of present operations.

The property is bounded on the north by the Daly West ground of Park Utah Consolidated Mines, and on the west by the Daly Judge holdings of the same company. Both of these areas have been highly productive. It is expected, therefore, that a large portion of the New Quincy territory will be found to be mineralized.

Current production from the New Quincy is all being derived from development work, and the ore mined is brought to the surface through the adjoining workings of Park Utah Consolidated. As development proceeds and stoping operations are begun, it is planned to increase the present rate of output. A force of 40 men is now employed at the property.

Too Much Ore at Depth Embarrasses Ooregum Gold

AT THE annual meeting of Ooregum Gold Mining of India, Ltd., operating in the Kolar gold field, Mysore, it was stated that the ore extends for 3,300 ft. on the run of the reef, and in the five deepest levels—the 65th to 69th—the length of payable quartz has averaged 2,097 ft., the width, 20 in., and the assay value 28 dwt. ($28) per ton. "It is not often that the extent of the payable ore in the bottom levels is a source of embarrassment to a mining company," said Henry C. Taylor, a director of the company, "but such a position is beginning to arise with us, the problem being how, with the maximum profit and safety, to mine this great area in the face of increasing rock temperatures and rock pressure. . . .

"Such conditions call for a more rigid form of support for our workings, and this has now taken the shape of walls of closely packed granite blocks spaced at regular intervals and supporting directly about 40 per cent of the area mined. . . . This new method of mine support is as yet in the early stages of trial, and time must elapse before its efficacy can be finally judged; but I can say that to date we are pleased with the prospect of its proving both effective and economical."

The 70th level of this mine is now being opened—this is approximately 6,380 ft. deep. Ventilation is receiving close study. An experimental air-cooling plant has already been on trial, and other types will probably be installed to find out what method is best suited to conditions.

Production from the mine last year amounted to 150,000 tons, or a little over 400 tons a day, with an additional tonnage of 158,000 tons of dump-sand milled. The continuity of the orebodies shows no present indication of material change at depth.

Champion Reef Gold Mines of India, Ltd., is also troubled with ventilation and ground-support problems, as was explained by Arthur E. Taylor at the annual meeting in London. This mine is also working at about 6,000 ft. depth. A mining system has been evolved whereby levels in stoping areas are supported by concrete and masonry in place of timber and pigsties. With this support for the levels, and by arranging for filling to follow closely the stoping faces —on the rill stoping system—it is hoped to mitigate the effects of rockbursts.

Natural ventilation is supplemented with fans. Electrical power is playing an ever-increasing part in the running of the entire mine plant.

Above—The sentinel tower at the North Forty stripping.
Below—The 350-ton shovel at work

Hibbing North Forty Stripping

THAT the North Forty stripping will be cleaned up by the Oliver Iron Mining Company in another year is shown in the lower illustration. The dark spot in the upper right-hand corner is the old Oliver Hotel, the only building still standing on the spot that was once the business district of Hibbing. The hotel stands on the extreme south line, and after one more cut has been made by the 350-ton shovel shown in center the hotel must be removed. This shovel worked on the high bank all last winter, loading out more than 1,000,000 yd. of overburden, and is now busy on clean-up work over the orebody, getting ready to load ore in another 30 days. Some of the 42,000,000 tons of ore exposed by this stripping job has been loaded out, but about 90 per cent remains.

The only other structure on the unstripped portion of the "Forty" is the sentinel tower near the west side close to the bank, which gives an unobstructed view of the big Hull Rust, Mahoning, Pool, Burt, Sellars and Day pit running 1¾ miles west, ½ mile north, and ¾ mile east. From this vantage point all the 19 shovels and 25 locomotives and trains needed to get out the ore can be observed and immediate assistance sent by telephone from the shops, or repair gangs summoned, that may be necessary because of a train derailment or a shovel breakdown at one of the pits.

Development of High-Grade Discovery in Denn Mine Indicates Large Orebody

Crosscuts on Bottom Level of Property of Shattuck Denn Mining Show Extent of Sulphide Orebody Discovered Late Last Year

RECENT developments at the Denn mine of Shattuck Denn Mining point to the discovery of another important orebody in the Bisbee district of Arizona. When the Denn mine was closed down during the 1920 depression in the mining industry, the shaft had been sunk to a depth of 1,800 ft. in an effort to explore under a large area of leached ground which was present on several of the higher levels. The work was hindered by several difficulties, the principal one being the large amount of water encountered, so in 1920 the mine was closed and allowed to fill with water. Subsequently, water was drained off by operations in the mines of adjoining companies and work was resumed late in 1925, at which time the Denn-Arizona Copper Company was merged with the Shattuck Arizona Copper Company to form the Shattuck Denn Mining Corporation.

Following the merger, the shaft was sunk to the 2,000 level. Owing to extremely loose and broken ground, the sinking of the shaft was attended by many problems. Methods employed by Joseph Walker, the company's superintendent, have been described in a previous issue of the *Engineering and Mining Journal*. Late in 1927 a drift was begun to the west of the shaft and roughly paralleling the Dividend Fault and the Calumet & Arizona property line. At a point approximately 350 ft. from the shaft, this drift encountered primary sulphide ore, which continued for more than 200 ft. This drift has been stopped temporarily by the presence of gas (nitrogen), and a raise is being put up to the 1,800 level for ventilation. This raise was up about 50 ft. as last reported, and most of it was in sulphide ore.

A crosscut running south from the main drift encountered approximately 30 ft. of high-grade copper glance averaging better than 20 per cent copper. After a few feet of limestone, another sulphide was met, which persisted as this crosscut was turned to the west and was later joined up with the main drift. A small stope has been started on the sulphide in this crosscut, and the ore now being shipped averages around 7 per cent copper.

With the purpose of exploring the ground for 200 ft. below the 2,000 level, the company has been diamond drilling from that level, with gratifying results. A hole, put down from the east end of the orebody on the 2,000 level and inclined to the south at a 75-deg. angle, showed 200 ft. of ore averaging 6 per cent copper. One hundred consecutive feet of this hole averaged 10 per cent copper and several assays ran as high as 15 and 20 per cent. A second hole, the top of which was 50 ft. to the west of the first hole and the bottom of which was about 100 ft. from the bottom of the first hole, went through ore of the same character, and other diamond-drill holes, now in progress but not yet fully reported, are confirming and extending the orebody disclosed by the first two holes.

No work has been done between the 1,800 and the 2,000 levels other than the raise heretofore mentioned. The top of the orebody appears, therefore, to be somewhere between these two levels. The drilling demonstrates that it extends to a depth of 2,200 ft. Length and width are as yet undetermined, but are estimated, on the basis of present data, as 250 and 60 ft. respectively. Horizontal dimensions are increasing with depth.

The company is now preparing to sink the Denn shaft to 2,200 ft. and to block out the orebody on that and the 2,100 level preparatory to mining operations and further exploration at greater depth. The present hoisting equipment is inadequate, and an order has been placed with the Nordberg company for a hoist with a daily capacity of 700 tons, with electrical motors and flywheel. A new steel headframe is to be installed by the Kansas City Structural Iron Works. Electrical power will be purchased from the Arizona Edison Company.

The Denn ground lies along the Dividend fault on the east side of Sacramento Hill. Geologically, conditions resemble closely the old Czar-shaft area of the Copper Queen mine of Phelps Dodge. With the exception of the copper glance encountered in one of the crosscuts on the 2,000 level, the orebody now being developed at the Denn is largely chalcopyrite. Gold and silver assays run about $2 a ton. This orebody is definitely associated with the Dividend fault, and the fault may now be considered a proved ore producer to the east of Sacramento Hill, as it was in the older mining areas to the west of the hill. The Denn has about 4,500 ft. along the Dividend fault, and company officials believe that other bodies similar to the one now being developed will be found as this fault and the ground just south of it is prospected. The present orebody is about 2,500 ft. to the north of the Campbell orebody of Calumet & Arizona and both bodies are close to and west of the Mexican Canyon fault. Low-grade sulphide ore, with bunches of high-grade, has been found on the 1,450 and 1,600 levels of the Denn, and further exploration of the ground around the bottom of the leached area is being conducted on the 1,800 level.

The Shattuck mine of Shattuck Denn Mining, in the westerly area of the Bisbee district, is now shipping both copper and lead ores, and is doing much development work. Recently the silica which was associated with the rich orebodies formerly developed on the 300 and 400 levels and cut off by the Shattuck fault was found in the surface tunnel running south from a point 80 ft. above the collar of the Shattuck shaft. The surface tunnel is being driven with the object of finding these orebodies if they exist to the south of the fault.

Copper ore from the Shattuck and the Denn mines has from initial operations been treated by the Calumet & Arizona smelter at Douglas. In the last few weeks the smelting contract has been renewed between the two companies. Calumet & Arizona is connected underground with the Denn mine, and the small flow of water from the Denn is delivered underground to the Calumet & Arizona and pumped by the latter from its Junction shaft.

Michigan Copper Mines Put at $1,000,000 Less Than Last Year

Franklin G. Pardee, acting appraiser for the Michigan Tax Commission, has recommended a reduction under last year of $1,108,000 in the assessed valuation of the copper mines of Houghton and Keweenaw counties. The recommendations were submitted at a public hearing held in Houghton May 15 by the State Tax Commission.

The appraiser recommended a valuation of $27,921,000 on Houghton County mines, compared with a valuation of $29,029,000 in 1927, a reduction of $410,000. In Keweenaw County, Mr. Pardee recommended a valuation of $8,985,000, against $9,683,000 in 1927, a reduction of $698,000.

The recommended reductions, however, do not extend to all properties, as many of the valuations are unchanged from last year, and Calumet & Hecla Consolidated was advanced from $12,790,000 to $13,405,000. A decrease of $750,000 was recommended for the Copper Range Mines.

Celite Products Purchases Redwood City Plant

Celite Products Company has purchased the National Magnesia Manufacturing Company's plant at Redwood City, Calif., and it is rumored that the first-named company will spend $100,000 in remodeling this plant. The Redwood plant was engaged in the manufacture of "85 per cent magnesia" heat-insulation products, using calcined magnesite produced by California mines and diatomite from a deposit near Lompoc which it recently acquired. Celite Products will make additional insulating products. The plant will be operated as a subsidiary under the name of National Magnesia Company.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Outlook for Kalgoorlie Area Is Poor as Gold Yield Continues to Decline

Melbourne, April 17, 1928—The gold output of Western Australia for March was only 23,603 oz., which is the lowest monthly return since the discovery of Coolgardie. This decrease is not owing entirely to the depression in the industry, as Kalgoorlie was visited by a cyclone during the month and this was responsible for interruption of treatment operations. The outlook for Kalgoorlie mines shows no improvement.

It would appear that the Oroya Links, Ltd., a London-controlled company, whose property at Kalgoorlie has been closed down since the middle of last year, has no intention of resuming operations, as instructions have been received to cease bailing at the North Blocks shaft. This shaft has been kept unwatered under an arrangement with the adjoining mines. If water is allowed to rise in the shaft results will be serious to future operations in the field, for flooding of the Associated, the Perseverance, Lake View, and South Kalgurlie mines would ensue. Unless one of the adjoining mines acquires the Oroya Links, the only hope appears to be for the department of mines to come to the aid of the mines likely to be affected, and to subsidize pumping operations. The quantity of water raised daily is only 60,000 gal.

THE MOST encouraging features of Western Australian gold mining are the prospect of large scale operations at Wiluna, and the hope that the Sons of Gwalia, which recently arranged with the government for a loan of £78,000 to carry out development work, will make good.

Contrary to expectations, the general manager of Wiluna Gold Mines, Ltd., in Western Australia, H. E. Vail, has announced that the flotation process will be adopted for concentrating the gold content of the company's ore. The gold would be recovered subsequently by roasting the concentrates and submitting them to cyanide treatment, which would permit a saving of 3s. a ton on the present practice of treating sulphide ore at Kalgoorlie, and would enable the company to wet-crush the ore and carry out mining operations under the most favorable conditions. In tracing the history of experiments, Mr. Vail said that it became necessary for the consulting metallurgist, T. B. Stevens, to discover why the results obtained in laboratory tests were not confirmed in practice. Analysis and observation proved that the Wiluna ore would have to be prevented from coming into contact with the air, and when this was done entirely satisfactory results were obtained without departure from existing methods of fine grinding. This discovery was of great importance to the Wiluna mines and other companies throughout the world which used the flotation process for treating sulphide ore containing gold. Results have been confirmed by Alfred James, former president of the Institute of Mining and Metallurgy, who has been engaged to inspect the field and advise the directors regarding methods of working the mine and recovering the gold.

Lead Cliff Mining Develops Property in Idaho

Lead Cliff Mining is actively developing its property, consisting of seven mining claims, in the Moyie-Yaht district near Bonners Ferry, Idaho. The company has a crew at work driving a tunnel to crosscut the principal ledge at 1,500 ft. beneath the surface. The ore is silver-lead. Lead Cliff Mining was recently incorporated with a capital stock of $200,000.

Huronian Belt to Enter New Brunswick Field

R. S. Dening, managing director of the Huronian Belt Company, Ltd., announces that his company and its subsidiaries are preparing to enter the New Brunswick and Nova Scotia fields. Mr. Dening recently returned to Toronto from a visit to these areas. Work has already started on three or four prospects under the direction of W. M. Goodwin. Arrangements have been made for co-operation with local interests for further exploration of mineral areas.

Sodium Products Will Reopen

Sodium Products Corporation will reopen its sodium mine at Camp Verde, Ariz., on June 1. Recently company officials conferred with the Santa Fe railroad about the construction of an extension road from Clemenceau to the mine. The property shut down because of market conditions for its product.

Salvage Conference Will Be Held at Wilmington

Representatives of large industrial corporations and public utilities are to meet in Wilmington, Del., on June 6 and 7 for a second conference to consider problems connected with the disposal of waste or surplus material and obsolete equipment. A preliminary conference was held in New York in December. Sufficient interest was shown then to warrant the organization of a salvage division, operating in connection with the National Association of Waste Material Dealers, Inc. In 1927 the value of scrap metal produced from waste materials was $314,000,000. The conference is being held in Wilmington upon the invitation of E. I. duPont de Nemours & Company.

London Letter

By W. A. Doman
Special Correspondent

New Nigerian Tin Deposits, Owned by Kassa Mining, Are Reported

London, May 8, 1928.—Frank B. Powell, who has been on a visit of inspection to Nigeria on behalf of a group of mining companies, has reported that some of the richest tin deposits have yet to be worked. He refers to fluvio volcanic deposits on the ground of Kassa Mining, where values over the richest portions run from 10 to 15 lb. he reports. The tin is concentrated on the bottom, at depths varying from 15 to 40 ft., in a band of wash varying from 10 in. to 2 ft. 6 in. thick. This tin is costing less per ton to produce than any other tin in Nigeria. Fluvio volcanic hills, Mr. Powell says, are in reality the ancient tin-bearing river beds, which were covered by lava flows in the past. Parts of these beds have been uncovered and the tin redeposited in newly formed valleys and river channels. The richness of these deposits indicates that very rich occurrences of tin still remain under the fluvio volcanic hills which have not been eroded.

FROM a fairly good source I have heard that the Nitrate Association, acting under instructions of the Chilean government, has informed producers that they must not sell nitrate, f.o.b. Chile, at lower prices than 16s. 4d. per metric quintal for May-June shipment, or 16s. 6d. throughout the coming year. Sales below these prices will be regarded as culpable and will be investigated by the authorities. On the other hand, I understand that the Chilean government will distribute to producers, pro rata on production during the first three months of 1928, the sum of 10,000,000 pesos, equal to £250,000. Producers who do not observe the minimum price regulations will not participate in the subsidy.

Anglo-Chilean Consolidated Nitrate Corporation shows a deficit at the end of 1927 of $3,898,000, compared with $2,243,000 in 1926. It utilizes the so-called Guggenheim nitrate process, an immense plant having been put in operation in 1926.

Shareholders in Gaika Gold Mining, which owns property in Matabeleland, Rhodesia, have had something of a shock in a statement just issued by the directors. The underground manager reports that the mine is suffering for want of past development of paying ore. There is no doubt, he says, that much has been taken for granted in crosscuts apparently failing to cut reefs in the probable horizons. Also, too much reliance has been placed in sampling, which, when judged from the old chisel marks, was in many cases obviously misleading.

Isle Royale Will Adopt Retreating System

IN COMMON with other Calumet & Hecla properties, Isle Royale is using the retreating system of mining at its mine in the Michigan copper district. Extraction of a greater percentage of copper-bearing rock and salvaging of supplies, pipes, and trackage is permitted by the use of this system. In Isle Royale, drifts only 7x7 ft. in size are driven through poor rock and drifts 9x18 through the richer rock, further reducing costs.

Mineralization in the west crosscut of Mayflower-Old Colony's 1,700 level is not yet commercial, although the vein contains fine copper. The north drift is being extended in the hope that the mineralization may change. It is planned to open the lode to the south of the crosscut as well.

Copper shipments by boat have started from the Michigan mines. Metal has not been moving freely during the last few weeks, but it is expected that business will improve as the lower rates by water become available.

Surface Structures to Be Built at Bonanza Soon

MANAGEMENT of Granby Consolidated has decided to start construction of a road and surface structures at its new Bonanza development. The claims comprising the Bonanza group are about a mile west of the smelter at Anyox, B. C. A diamond-drilling campaign was carried out on these claims last summer, and the results justified the company in its decision to finance the development of the property as reported last week.

To date a suspension bridge has been built across the creek and a foot road cleared. A road will be constructed from the beach (the property is only one mile from tidewater) to the claims for the transportation of building materials and supplies. A compressor, crusher, bunk house to accommodate 60 men, and aërial tramway to the mill will be built.

Texas Gulf Sulphur Building 400,000-Ton Plant

Within the next two years it is expected that the Texas Gulf Sulphur Company will be producing 400,000 tons of sulphur annually from its new mine at Boling Dome, Fort Bend County, Tex., according to Wilber Judson, vice-president of the company. Mr. Judson said that the plant which is now being constructed by the company at Boling Dome for mining sulphur will cost more than $5,000,000. Within a few years the plant will be enlarged to a capacity of 1,000,000 tons of sulphur yearly. The plant will be equipped so that either lignite or fuel oil may be used for the boilers. The company owns 1,500 acres of lignite land in Milam County, Tex., from which it hopes to obtain its fuel supply at low cost.

Personal Notes

T. A. RICKARD will leave San Francisco on June 2 en route to New York via Panama.

E. H. CLIFFORD, consulting mining engineer to the British South Africa Company, visited Rhodesia recently.

CHARLES SPEARMAN has been appointed consulting engineer of Jay Copper to succeed HENRY J. STEWART.

R. J. IRVINE and J. W. HOPKINS are in charge of operations of the Alhambra Mining Company, Red Mountain, Calif.

RICHARD B. KETCHUM has been appointed dean of the school of engineering of Utah University, which includes the undergraduate school of mines. He assisted in the design of the Arthur

RICHARD B. KETCHUM

plant of Utah Copper, and designed surface structures for the Standard Coal Company at Standardville, Utah. As chief engineer of the Independent Coal and Coke Company, he opened and developed the company's property at Kenilworth, Utah. Dean Ketchum has been head of the department of civil engineering at the University of Utah since 1924.

S. POWER WARREN, consulting metallurgical engineer of Golden, Colo., sailed for London recently on professional business.

L. S. STRICKLER, of San Francisco, has opened an office at 627 Commercial St., San Francisco, as successor to C. A. LUCKHARDT.

ERNEST GAYFORD, of the General Engineering Company, left Salt Lake City on May 14 on a business trip to Winnipeg, Manitoba.

C. V. AVERILL, mining engineer, has been placed in charge of the Redding branch office of the California State Mining Bureau.

STERLING GRANT has been appointed manager of Moffatt-Hall Gold Mines, operating in the Kirkland Lake area of northern Ontario.

I. A. ETTLINGER recently gave a series of three lectures before the economic geology class of the Harvard Engineering School.

H. D. MISER, E. F. BURCHARD and D. F. HEWITT, of the U. S. Geological Survey, are in Woodstock, Va., examining manganese deposits.

HERMAN HARMS, state chemist of Utah, and Mrs. Harms are making a three months' trip to Europe, during which they will visit Germany, England, and Belgium.

R. J. MONTGOMERY, professor of ceramics at Toronto University, will study the brick- and tile-making establishments of Ontario for the provincial department of mines.

H. D. MORSE, mining engineer and geologist of Butte, Mont., is in charge of the development work planned at the property of Auxer Gold Mines, near Hope, Wash.

H. C. BOYDELL, recently appointed consulting engineer for Huronian Belt, has returned from a visit to Admiralty Island, Alaska, and is now engaged for his company in British Columbia.

Dr. O. C. LESTER, of the University of Colorado, recently addressed a joint meeting of the Rocky Mountain Association of Petroleum Geologists and the Colorado Engineering Society, on geophysics.

Dr. ANDREW C. LAWSON, faculty member of the University of California for 38 years and professor of geology for many years, has announced his retirement from university work as of July 25, 1928.

M. L. CLINE, director of safety and welfare in the Western Department of the American Smelting & Refining Company, is spending a month in the Salt Lake district, supervising the safety and welfare work at the company's plants there.

H. W. YORK, vice-president of the American Smelting & Refining Company, with headquarters in New York City, visited the Salt Lake district recently to inspect a new tailings impounding dam at the company's Garfield plant.

WALTER K. MALLETTE, who is in charge of the design and construction of the new electrolytic zinc plant which will soon be placed in operation by Sullivan Mining at Kellogg, Idaho, is recovering from a recent operation for acute appendicitis at St. Luke's Hospital in Spokane.

Prof. E. L. BRUCE, of Queens University, Ontario, has been chosen to undertake a geological survey of the district north of the Flin Flon region in the interests of the Canadian National Railway system. The Canadian National is constructing the railroad from The Pas to Flin Flon.

JOHN P. HUBBELL, formerly assistant chief of research of New Jersey Zinc, has become a partner in the firm of Singmaster & Breyer, chemical engineers and metallurgists, 420 Lexington Ave., New York City.

CHARLES M. SCHNEIDER, until recently in the engineering department of U. S. Smelting, Refining & Mining at Salt Lake City, has joined the engineering staff of the Mine & Smelter Supply Company, Denver.

BENNETT R. BATES, mining engineer, is now associated with his brother, FRANCIS BATES, in the formation of the Bates Company, engineers, to carry on the practice of consulting and general engineering, with headquarters in the Bradbury Building, Los Angeles.

FREDERICK G. CLAPP has gone to southern and western Persia, acting under the instructions of the imperial government of Persia, on a study of some geological and technological phases of the oil fields there. He will return to northern Persia by way of the Iraq oil fields.

W. D. JOHNSTON, JR., has resigned his position as assistant professor of geology at the New Mexico School of Mines to accept an appointment with the ground-water division of the U. S. Geological Survey. Mr. Johnston has also resigned from the State Bureau of Mines and Mineral Resources.

PHILIP R. BRADLEY, of San Francisco, has left on his annual tour of inspection of properties of the Treadwell Yukon Company. Mr. Bradley will visit the Errington mine, in the Sudbury district; the Wernecke mine, in Mayo district, and the Alaska Juneau property, of which he is consulting engineer.

D. D. IRWIN, for the last six years general superintendent of the Copper Queen branch of Phelps Dodge Corporation, has resigned his position to become general manager of Roan Antelope Copper Mines, in Northern Rhodesia. Mr. Irwin recently returned to Bisbee, Ariz., from London, England, where, after consultation with the directors of the company, he was offered the new position. Mr. Irwin has been employed at the Morenci, Burro Mountain, Moctezuma, and Copper Queen branches of the Phelps Dodge company for a period of sixteen years. He was secretary to the assistant to the president at Douglas for two years. He had direct supervision of the erection of the Warren concentrator, the new Douglas smelter, and the lead smelter; and directed the underground mining operations at Bisbee, the open pit mine at Sacramento Hill, and the operation of the leaching plant. Development and operation of the Roan Antelope will require not only the establishment of mining methods, the erection of a 5,000-ton mill and reduction works, but also the building of a townsite and the development of hydro-electric power and adequate transportation facilities. Mr. Irwin expects to be at the Roan Antelope property by the middle of September. At present no attempt will be made to fill his position at Bisbee.

An Appreciation of Vernon Stone Rood

VERNON STONE ROOD, general manager of the Utah Apex Mining Company, Bingham, Utah, who died May 1 at Saranac Lake, N. Y., was prominent in the brilliant group of younger mining men and metallurgists so successful in the development and application of modern methods and processes in Utah.

VERNON STONE ROOD

On graduating from the Massachusetts Institute of Technology in 1907, Mr. Rood obtained employment as a miner at the Daly West mine, Park City, Utah, to gain practical mining experience, and the following year went to Bingham, where he worked as a machine miner for the Utah Copper Company. His first association with the Utah Apex property was in 1909 as an employee of the contractor who opened the main shaft. On completion of this work, he entered the employ of the company as a machine miner, was promoted to shift boss, and then to mine engineer, as which he served two years. He was promoted to superintendent in 1912, and to general manager of the property in 1916.

Mr. Rood, during the administration of R. F. Haffenreffer, Jr., president of the company, was largely responsible for the development of the mine from the prospect stage, when it bore heavy financial obligations, into a substantial dividend payer and one of the best-equipped properties in the state. He showed exceptional ability and tenacity in the development of heavy sulphide ores in deep workings. The nature of the deposit made it extremely difficult to block out large reserves in the Utah Apex, but in the years that the mine was under his management he always kept the development work in advance of extraction requirements. In spite of the handicaps created by involved litigation, to which the company was a party, and when, for a long period, operations were carried on largely to meet conditions demanded by the attorneys. Mr. Rood demonstrated his ability as a mine manager by making the Utah Apex one of the largest individual lead producers in the country.

Indicative of the changing methods and improvements necessary to keep abreast of conditions is the fact that during Mr. Rood's connection with the company the mill of Utah Apex was reconstructed four times. Milling operations have always been notably efficient at the property, and it was under his supervision that gravity methods of concentration were replaced by flotation. His illness made it impossible for him to give his personal attention to the most recent plant changes, but he kept in touch with these and with all operations at the property, through the medium of correspondence, until within a few days of his death.

Mr. Rood was born Nov. 2, 1883, at Freeland, Pa., a son of Mr. and Mrs. Vernon Harris Rood. He was educated in public schools, the Highland Military Academy, at Worcester, Mass., and the Massachusetts Institute of Technology. In 1920 he married Josephine Lindley, daughter of the late Judge Curtis H. Lindley, of San Francisco. Mrs. Rood was an inspiring helpmate and his constant and devoted nurse throughout his illness. Besides Mrs. Rood, he left two brothers and two sisters, Francis Rood, of Detroit; C. S. Rood, of Los Angeles; Mrs. C. C. Cushwa, of Salt Lake City; and Miss Esther Alice Rood, of New York City.

Until his health failed, Mr. Rood was a man of exceptional strength and activity, and influential in community and social life. He had been a member of the American Institute of Mining and Metallurgical Engineers since 1912, a director of the Utah Chapter of the American Mining Congress since 1919, and was a member of the Alta and University clubs of Salt Lake City, and of the Delta Tau Delta fraternity.

Vernon Rood was an able engineer and executive, a good citizen, and a steadfast friend. He met his long illness and death with the patience and fortitude that was to be expected from a kind and courageous gentleman.

ERNEST GAYFORD,
A. G. MACKENZIE,
J. A. NORDEN.

Salt Lake City,
May 8, 1928.

Unveil Bronze Tablet to W. G. Miller

WILLET G. MILLER, deceased, provincial geologist of Ontario, was honored on May 3 by the unveiling of a beautiful bronze memorial tablet to him in the entrance hall of the geology building, University of Manitoba. The inscription on the tablet reads, "In memory of Willet Green Miller, a member of the Canadian Institute of Mines and Metallurgy, 1898-1925, and president from 1908-1909, provincial geologist of Ontario, 1902-1925. His work on the Pre-Cambrian is a monument of inspiration to all students of geology."

Book Reviews

Losses From Jarosite

THE OCCURRENCE OF JAROSITE MINERALS IN OXIDIZED LEAD ORES AS A FACTOR IN METAL LOSSES. By R. E. Head and Virgil Miller. Report of Investigations, U. S. Bureau of Mines; mimeographed serial No. 2870; April 1928. Pp. 13.

THIS serial points out that failure to treat successfully some oxidized lead ores may be attributed to the presence of argentojarosite and plumbojarosite. The conclusions reached as a result of investigations conducted on such ores at the Intermountain Station of the U. S. Bureau of Mines indicate that (1) all oxidized ores of lead, silver, and gold having a reddish-brown or yellow color should be examined to determine whether they contain members of the jarosite group of minerals; (2) the exceedingly small size of jarosite crystals, their low specific gravity, and their micaceous character render treatment by gravity methods of concentration practically impossible; (3) members of the jarosite group of minerals do not sulphidize readily when treated with sulphidizing agents at concentrations commonly used in commercial practice; (4) tailings resulting from the treatment of oxidized lead ores on which low recoveries of lead and silver are made should be examined carefully to determine whether the losses are due to the existence of plumbojarosite and argentojarosite; and, (5) jarosite ores which by reason of their relatively low metal content and distance from transportation facilities are of doubtful value may be beneficiated by a type of pyrometallurgical treatment best suited to their characteristics and location. The results of volatilization experiments of several of these ores suggest that this method of treatment should be given consideration.

The serial is a noteworthy contribution to ore-dressing literature, and should be of value to operators treating oxidized ores, particularly to those whose operations are situated in the Intermountain district.

H. D. KEISER.

A CONSIDERATION OF SOME OF THE PROBLEMS OF THE CHLORIDE VOLATILIZATION PROCESS. Technical Paper No. 3. By Robert H. Bradford and Carrol Max MacFarlane. Published by the University of Utah in co-operation with the U. S. Bureau of Mines. Pp. 19. Price 15c.

This paper considers a number of the problems encountered in practice that have prevented any decidedly successful commercial application of the chloride volatilization process. The authors, on the basis of their laboratory results, suggest a plant arrangement that should obviate the major difficulties and take advantage of the more active chloridizing properties of hydrogen chloride, which would make possible the treatment of an ore with a high calcareous gangue. The paper contains numerous illustrations and graphs, and should be of considerable value to those interested in the chloride volatilization process.

H. D. K.

PREPARATION OF XANTHATES AND OTHER ORGANIC THIOCARBONATES. By Laurence S. Foster. Technical Paper No. 2. Published by the University of Utah in co-operation with the U. S. Bureau of Mines. Pp. 6. Price 10c.

An excellent history of the xanthates and a valuable bibliography on the subject are presented in this paper. Methods by which iso-amyl, n-hexyl, n-heptyl, n-octyl, n-nonyl, and n-lauryl and other xanthates may be prepared are given in detail. A complete description is also given of the methods used in the preparation of potassium alkyl monothiocarbonates and sodium n-butyl and potassium iso-amyl trithiocarbonates. As the author points out, many of these compounds have not previously been recorded. The flotation research worker will undoubtedly find the paper a desirable addition to the existing literature on reagents.

H. D. K.

METALS AND MACHINERY SECTION, Part II of the Record Book of Business Statistics. Bureau of the Census, Washington, D. C. Sixty pages. For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 10c.

This publication contains all available monthly data, in many instances as far back as 1909, pertinent to metals and machinery. Included are data on shipments, receipts, imports, stocks, and consumption of ores; production, wholesale prices, and related information on pig iron, steel, copper, zinc, lead, tin, and other metals; also, figures on production, shipment, prices, and stocks on hand of fabricated metals and machinery. Data on patents granted during the period 1913-1926 are also given.

METAL STATISTICS 1928. Twenty-first Annual Edition. American Metal Market, 11 Cliff St., New York. Pages 552. Price $2.

The latest edition of this well-known little volume contains the same generous compilation of statistical information concerning ferrous and non-ferrous metals that has been distributed in previous years. Certain new tables have been introduced in the hope of increasing the publication's usefulness. The editors are B. E. V. Luty and J. F. Brady.

"Foote-Prints" is the title of an attractive publication recently received from the Foote Mineral Company, 16th and Summer St., Philadelphia. The title in full is really "Foote-Prints on the Rare Metals and Unusual Ores." Some years ago this company issued at intervals a bulletin entitled "Mineral Foote-Notes." Publication of it was discontinued in the lean years following the war. Since then so many letters have been received from interested readers who hoped that the publication might return to life, that the company finally decided to meet their wishes. "Foote-Prints" is the result. The price is 50c. per copy, four numbers for $1. How often it will appear is not stated; presumably it will be quarterly. The first issue contains an article on "Manganese in Face Brick," by W. D. Richardson, and a reprint of the review of the market in uncommon ores and metals in 1927, which was written by H. Conrad Meyer, vice president of the company, for the Annual Review Number of *Engineering and Mining Journal*.

NEVADA'S MINERALS—The prospector and mining student in Nevada will find the University of Nevada Bulletin Vol. 22, No. 1, of considerable use. It is entitled "A Table for the Identification of Nevada's Common Minerals." This bulletin has been prepared by Oliver R. Grawe for the Mackay School of Mines and the State Mining Laboratory. It consists of thirteen pages of elementary mineralogical information. Its principal feature is the accompanying wall chart, 26½ in. high by 33 in. wide, which contains a table for identification of the common minerals of the state. The information thus tabulated includes those features of the various minerals on which their determination depends. In the last two columns are given the mode of occurrence and chief uses of each mineral. Copies of bulletin and chart may be obtained from the Mackay School of Mines at Reno for 50c. The chart alone costs 25c.

FIRE CLAY—The Topographic and Geologic Survey of Pennsylvania has issued Bulletin M 10, entitled "Fire Clays of Pennsylvania." The author is J. B. Shaw. Manufacture of fire brick and other refractory products is an important industry in Pennsylvania because of the extensive metallurgical industry existing in that state.

NEW ZEALAND GEOLOGY.—The New Zealand Geological Survey has issued two bulletins, Nos. 31 and 32, entitled, respectively, "The Geology of the Tongaporuto-Ohura Subdivision, Taranaki Division," by L. I. Grange, and "Minerals and Mineral Substances of New Zealand," by P. G. Morgan.

ESTIMATING CO_2 — The volumetric estimation of carbon and carbon dioxide in rock products by electrical incandescence is described by Walter J. Pitt in the Feb. 6 issue of the *Chemical Engineering and Mining Review* of Melbourne, Australia. Sketches of the apparatus used are given.

GOLD ASSAY—A short article by A. O. Watkins in the Feb. 6 issue of the Melbourne periodical mentioned in the preceding paragraph describes the use of manganese in the assay of fine gold. The author is the late chief chemist and refiner of the Royal Mint at Perth.

Market and Financial News

May Dividends $795,067 Higher Than a Year Ago

DIVIDENDS disbursed by mining companies this month establish a new May record. However, the total of $17,359,998 is somewhat lower than in February, 1928, or November, 1927, the two preceding-quarter months. The following table gives some idea of the trend of mining company dividend distributions for the second month of each quarter during the past year and a half:

	1927	1928
February	$16,137,913	$17,797,953
May	16,564,931	17,359,998
August	16,965,732	.....
November	17,846,584	.....
Average	$16,878,890	$17,578,976

Comparing the list of companies paying dividends this month with those reported a year ago, the following variations are noted in proceeding down the list: Freeport Texas, sulphur producer, has increased its quarterly rate from $1 to $1.75 per share, and United Verde Extension has decreased its quarterly payment from $0.75 to $0.50 per share. General Development, Gladstone Mountain, Dome Mines, Patiño Mines & Enterprises, and St. John del Rey were members of the list last May that do not appear this month. On the other side of the ledger National Lead preferred "B" and Granby Consolidated were not on the May, 1927, list.

Compared with the list for February, 1928, the more important of the missing members are Bingham Mines, Chief Consolidated, Sunshine Mining, and Teck-Hughes. Bingham Mines paid its regular quarterly payment in April and Teck-Hughes is a semi-annual payer appearing in August and February. Chief Consolidated and Sunshine Mining passed their dividends, due in May, presumably because of the effect of the prevailing lower metal prices on earnings, and a desire to add to reserves.

***E.&M.J.* Compilation of Mining Dividends and Yields for May, 1928**

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
American Smelting & Refining	Various	$2.00 Q	$1,219,960	4.2
Anaconda Copper, c, z, l, s	Various	0.75 Q	2,250,000	4.2
Bunker Hill & Sullivan, l. s	Idaho	0.75 MX	245,250	6.6
California Rand, s	Calif.	0.01 BM	12,800	....
Colorado Fuel & Iron, pfd	Various	2.00 Q	40,000	5.6
Freeport Texas, su	Texas	1.75 QX	1,277,127	9.6
Homestake Mining, g	S. D.	0.50 M	125,580	8.3
International Nickel, pfd., n., c	Ont., W. Va.	1.50 Q	133,689	5.2
Miami Copper	Ariz.	0.375Q	280,168	7.8
National Lead, pfd. "B" l	Various	1.50 Q	375,000	5.0
New Cornelia Copper	Ariz.	0.50 Q	900,000	7.1
New Jersey Zinc	Various	2.00 Q	981,632	5.5j
U. S. Steel, pfd	Various	1.75 Q	6,305,497	4.8
United Verde Extension, c	Ariz.	0.50 Q	525,000	9.3
Vanadium Corporation	Various	0.75 Q	283,775	3.5
Companies in other countries				
Amparo Mining, g, s	Jalisco	0.01 Q	20,000	....
Aramayo Mines, b, t, s	Bolivia	1.25Q*	1,050,000*	....
Cerro de Pasco, c, s	Peru	1.00 Q	1,122,842	5.9
Granby Consolidated, c	B. C.	1.00 Q	444,605	7.5
Hollinger Consolidated Gold	Ont.	0.10 4 wks.	492,000	8.1
Lucky Tiger-Combination, g, s	Sonora	0.07 M	50,073	10.9
Wright-Hargreaves (new), g	Ont.	0.05 Q	275,000	4.4
Total			$17,359,998	

c, copper; z, zinc; l, lead; s, silver; b, bismuth; g, gold; n, nickel; su, sulphur; t, tin; Q, quarterly; I, irregular; SA, semi-annual; M, monthly, MX, 25c. monthly and 50c. extra; BM, bi-monthly; QX, $1 regular and $0.75 extra; j, based on dividends for the last 12 months; * Swiss francs.

AMPARO MINING COMPANY, operating at Etzatlan, Jalisco, Mexico, reports net profit of $865 on its operations in Mexico, after deducting $78,880 for depreciation and depletion. Including investments and other income, the company reports a net profit of $66,939 for the year.

TONOPAH MINING COMPANY reports net profit of $238,296, after depreciation, for 1927, which compares with net profit of $216,254 in 1926, after depreciation and deductions for development work.

SENECA COPPER MINING COMPANY, one of the "Lake" producers, reports a deficit of $405,784, on its operation for 1927, after deducting all charges. This compares with a deficit of $429,824 in 1926.

DOLORES ESPERANZA CORPORATION, operating the Dolores and La Dura mines, in Mexico, reports for 1927 a profit of $140,078 before depletion, depreciation, and adjustment charges, which amounts to a deficit of $266,208 after deducting these charges. Operations at La Dura were interrupted by the Yaqui rebellion and a shortage of supplies caused by washouts on the railroad.

ARIZONA COPPER COMPANY, Ltd., with headquarters in London, has announced the date for its annual meeting as May 28. Action will then be taken on the recommendation of the board of directors for the declaration of a dividend of 9d. per share, less tax, on the ordinary shares.

International Zinc Cartel of Doubtful Importance

THE following comments on world zinc conditions at the end of April are supplied by International Metal Service, London, honorary foreign correspondents of the American Zinc Institute:

"Despite the advance of about £1 a long ton in zinc between April 1 and 30, the statistical position has undergone little change. So far as Europe is concerned, stocks are approximately stationary, thus indicating that European consumption is not only fully maintained, but has expanded that wee bit further necessary to absorb the additional quantity of high-grade metal imported from North America, Australia and Rhodesia.

"The stiffening in the price in April may be regarded as an anticipation of an international cartel coming into existence. Personally, we have never had any great faith in a cartel for zinc, for the reason that too many clashing interests exist. Assuming, however, that an international syndicate be born in enthusiasm, it will be remarkable if the infant develops much beyond the swaddling-cloth stage before troubles are encountered. But, even if a cartel can be made to last a year, it will serve its purposes. Producers of opposing nationalities will probably be prepared to adopt a give-and-take attitude at the outset in the common interest.

"One of the planks of the proposed convention is that curtailment of output shall be practiced by all constituent members whenever the London price of zinc drops below £26 and for such time as European stocks of metal exceed 25,000 long tons. It is around this second point that we can foresee distrust arising after awhile. There is no reason why the improvement in European consumption in the first quarter of the year should not make further headway in the current quarter.

"Our estimate of world stocks on May 1, 1928, is as follows:

	Metric Tons
United States	40,600
Canada (including afloat)	4,200
Germany-Poland	6,300
Belgium	5,100
France	1,400
Great Britian	1,400
Scandinavia	200
Other Europe	600
Australia (including afloat)	3,500
Far East	800
Elsewhere	2,000
Total	66,100"

NICHOLS COPPER COMPANY has announced an issue of 140,000 shares of Class B stock without par value, which has been taken by Phelps Dodge Corporation, Calumet & Arizona, and New Cornelia Copper. Proceeds from the sale of this stock will be used for the erection of a new refinery in the Southwest.

Nichols now has on its board representatives of the United Verde Extension and the Union Minière du Haut-Katanga, and will add new directors from the companies first mentioned above.

Anglo-Chilean Nitrate Earns $494,299 Before Depreciation and Depletion in 1927

NET INCOME of the Anglo-Chilean Consolidated Nitrate Corporation, and subsidiaries, in 1927, was $494,299, before allowing for depreciation and depletion.

Consolidated Statement of Income, For the Year Ended Dec. 31, 1927

Net operating income		$1,129,955
Other income from interest and discounts		49,258
Total income		$1,179,214
Charges against income:		
Interest paid	$435,942	
Taxes	87,099	
Amortization of bond discount	53,212	
Miscellaneous	108,660	684,915
Net income to surplus account		$494,299

Consolidated Surplus Account

Deficit of Dec. 31, 1926			$2,243,319
Net income for year 1927—as above	$494,298		
Less interest on first mortgage 7 per cent debenture stock (including payment for Jan. 1, 1928)			$1,223,649
On twenty year 7 per cent sinking fund debenture bonds	$1,155,000	2,378,649	
		$1,884,350	
Depreciation	$1,929,328		
Depletion	84,105	2,013,434	3,897,785
Deficit Dec. 31, 1927			$6,141,104

A feature of the year's operations was the change in sales policy of the corporation. Effective April 14, 1927, Anglo-Chilean withdrew from the Association of Producers of Chilean Nitrate, and made arrangements to sell through its own sales organization all nitrate produced in the future. The effect of this change in policy, on indicated world consumption of nitrate, and indirectly on future earnings of the Anglo-Chilean Corporation, is indicated in the following table, according to the report.

World's Consumption of Chilean Nitrate of Soda

(In Long Tons)

	1925–26	1926–27	1927–28
France	189,000	237,000	285,000
Belgium	128,000	86,000	155,000
Holland	118,000	88,000	124,000
Central Europe	95,000	99,000	226,000
Scandinavia	70,000	49,000	63,000
Spain and Portugal	104,000	108,000	110,000
Italy	55,000	45,000	50,000
United Kingdom	68,000	51,000	77,000
Totals	827,000	763,000	1,090,000
Egypt	161,000	155,000	175,000
	988,000	918,000	1,265,000
United States of America	914,000	680,000	1,100,000
	1,902,000	1,598,000	2,365,000
Other countries	175,000	158,000	175,000
	2,077,000	1,756,000	2,540,000

In commenting on the foregoing table, E. A. Cappelen-Smith, president of the corporation, states:

"The predicted consumption for 1927-28 of 2,540,000 tons is the largest, with a single exception, of any peace year in the history of the nitrate industry. The universal increase in demand for Chilean nitrate reflected by the accompanying table has been achieved, even with rising prices throughout the nitrate year, and seems to indicate the preference of the agricultural industry for Chilean nitrate over any nitrogenous fertilizer so long as that nitrate can be sold at reasonable prices.

"It is considered to be of the utmost importance for the continued prosperity, not only of your company but of the industry as a whole, that the system be continued of competitive selling at prices fixed by laws of supply and demand, and every effort is being made to assure this."

Isle Royale Shows Net Loss in 1927

Operations of the Isle Royale Copper Company for 1927 resulted in a net loss of $30,118 after deductions for depreciation and depletion had been made. The tonnage of ore mined was larger than in 1926, but slightly lower in grade, which, combined with the low price received for copper, resulted in decreased earnings. Comparative results for the past two years follow:

	1926	1927
Tons of rock treated	447,747	465,100
Cost of mining, transportation, stamping and taxes per ton of rock	$2.39	$2.50
Pounds of refined copper produced	11,017,000	11,391,338
Pounds of refined copper per ton of rock treated	24.61	24.49

The average cost of producing copper in 1927 was 11.55c. per pound, before allowing for depreciation or depletion.

Rio Tinto Earned £1,016,840 From Operations in 1927

Operations at the mines of the Rio Tinto Company, Ltd., continued without interruption in 1927. The lessened earnings resulting from the lower price of copper were offset to some extent by increased production of pyrites and iron ores. The financial statement follows:

Revenue Account for 1927

Debit

	£	s.	d.	£	s.	d.
Income tax and dues on shares in France, and Spanish taxes not otherwise charged	124,441	6	11			
Less credit from taxes	100,000	0	0			
	24,441	6	11			
Expenses of administration, salaries, rents, and general charges in London, Spain, and elsewhere	141,198	14	4			
Hospitals, medical assistance, workmen's pensions, and welfare	52,788	9	8			
				218,428	10	11
Interest on Spanish 6 per cent peseta loan				18,636	0	2
Allowance to directors, in accordance with the articles of association—1 per cent on profits over 10 per cent				5,725	13	2
Plant and outlay written down and written off, including railways				69,100	7	8
Staff pension fund				5,171	12	1
Balance				1,016,840	4	3
				1,333,902	8	3

Credit

	£	s.	d.	£	s.	d.
Profit on sale of produce, 1927, in Spain	204,508	1	5			
Elsewhere	1,016,838	4	6			
				1,221,346	5	11
Amount brought back from income tax suspense account				55,679	0	0
Interest and discount account				56,843	15	10
Transfer and other fees				33	6	6
				1,333,902	8	3

Utah-Apex Earnings Affected by Low Prices in 1927

UTAH-APEX Mining Company, operating in Carr Fork, Bingham Canyon, Utah, produced during 1927 6,375 oz. of gold, 611,866 oz. of silver, 27,516,000 lb. of lead, 6,426,878 lb. of copper and 9,058,041 lb. of zinc, from 266,841 tons of ore. Of this production 86 per cent was from concentrates, the remainder from direct shipping copper and from lead ores. The lead production decreased 8,000,000 lb. from 1926, zinc 800,000 lb., and silver 200,000 oz.; copper production increased 700,000 lb. Estimated ore reserves on Aug. 31, 1927, are 18,000 tons of 4 to 5 per cent copper ore, 45,000 tons of 4 to 5 per cent copper and 2 to 3 per cent lead ore, and 80,000 tons of 7 to 8 per cent lead and 5 to 6 per cent zinc ore.

Profit-and-Loss Account for 1927

Income

Proceeds of sales of ore, after deducting smelting charges and expenses		$2,402,371
Lease royalties		38,900
Interest, discount and miscellaneous receipts		50,625
Total		$2,491,897

Expenditures

Mining and milling expenses		
Mining	$1,088,568	
Development	384,549	
Milling	303,281	$1,776,400
Mill ore purchases		15,062
Insurance		91,526
Lease expense		2,003
General expenses		146,121
Taxes		43,755
Depreciation		49,824
Balance, being profit for the year, before providing for depletion and federal income taxes		367,201
Total		$2,491,987

MASON VALLEY MINES COMPANY, operating a copper property in Nevada, reports a net loss of $105,440 in 1927, after interest, depreciation, and other charges. President McNab states in his annual report that the continuance of operations beyond 1928 seems unlikely unless a much higher price for copper is realized or the grade of the ore mined increases unexpectedly.

The Market Report

Non-Ferrous Metals Strong in Sellers' Market

New York, May 23, 1928—Metal producers are well satisfied with the trend of the market during the last week. Copper sales have dropped off to close to average in the domestic market, but the price has advanced and sellers have little to offer. Silver has hit a new high record for almost two years. Zinc has been exceedingly quiet, but the metal is so firmly held that prices have advanced a few points further. Lead and tin prices show little change, but the activity in each of these metals has been greater than last week.

Copper Goes To 14⅝c., Delivered

The extremely active copper market of the two weeks ending last Wednesday has given way to a week of only a little better than normal sales in the domestic market, though the foreign demand continues unabated and about 73,000 tons has been sold already this month for export. The foreign activity lagged a little behind the domestic early in the month, when the buying rush began, so it is perhaps reasonable that it should persist a little longer now.

Late last Wednesday, the first sales were made at 14½c., delivered Connecticut; on Thursday, metal was sold in good quantities at both 14⅜ and 14½c., and one sale seems to have been made on Friday at the lower figure, but since then all sellers have realized 14½c. until this afternoon when a fairly general advance of ⅛c. resulted in some business at 14⅝c. in the East and 14¾c. in the Middle West.

Most producers are virtually sold out of May and June copper, and a fair amount of the business has been for July shipment. Certainly, consumers are buying ahead much further than they were, but it is likely that this is because they fear a shortage rather than because they have changed their habits. With copper at 14½c. or more, two big producing groups are at odds: one wants to hold production in check a little longer and advance prices further; and the other fears that higher prices would stimulate increased production by all the small producers and that it is preferable to continue to quote present prices and enlarge production in the big plants to meet the demand.

On Friday, May 18, the export price was advanced from 14⅝ to 14¾c., c.i.f.; business since then has been undiminished.

Lead Easy

Sales of lead in the domestic market, during the week ended today, have been in fairly good volume. A large proportion of those reported were outside the primary market centers, New York and St. Louis. Chemical lead in St. Louis has been available all week at prices below the recent 6c. level, but sales in that market have been scarce and it is not unlikely that St. Louis lead might be had for less than 5.975c. per pound, today, although none of the sellers are forcing their metal on the market. An increase in the differential between New York and St. Louis prices is not unnatural, as the 0.10c. margin that has prevailed recently is unusually small.

In New York, the market is slightly firmer, and except for one sale last Thursday all transactions have been at the 6.10c. level of the American Smelting & Refining Company's contract price. The volume of sales in the East has been but slightly less than average. July delivery has been specified in many of the negotiations and one fairly large lot for August delivery was contracted for. Prompt and June metal has been in less demand than the situation in recent weeks indicated. Spot lead in London continues to fluctuate within narrow limits, the result during the last week being a net advance of 1s. 3d.

Daily Prices of Metals

May	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
17	14.15@14.275	51.875	6.075@6.10	5.975	6.075
18	14.275	51.75	6.10	5.975	6.075@6.10
19	14.275	51.875	6.10	5.975	6.075@6.10
21	14.275	51.375	6.10	5.975	6.10
22	14.275	51.50	6.10	5.975	6.125
23	14.275@14 40	51.625	6.10	5 975	6.125
	14.275	51.667	6.098	5.975	6.100

Average prices for calendar week ending May 19, 1928, are: Copper, 14.196; Straits tin, 52.125; N. Y. lead, 6.094; St. Louis lead, 5.981; zinc, 6.063; and silver, 60.208.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
17	62½	62¾	67	230⅝	230½	20 3/16	20⅜	26 1/16	25 11/16
18	62⅞	63⅛	67⅛	231¾	230⅞	20¼	20⅜	26	25⅝
21	63 2/16	63⅜	67⅜	229½	228⅜	20 2/16	20 11/16	26	25⅝
22	63⅜	63 9/16	67¾	227¾	227⅛	20 3/16	20 11/16	25⅞	25 9/16
23	63⅛	63½	67⅞	228⅝	228⅜	20¼	20 11/16	25 13/16	25 9/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.87¾	60	27⅝	84s11d	21	4.87¾	62¼	28¾	84s11 1/2d
18	4.87 11/16	60⅞	27 15/16	84s11d	22	4.87¾	62¼	28½	84s11½d
19	4.87¾	61	28	.....	23	4.87¾	62⅞	28 1/16	84s11½d
					Avg.		61.542		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command seven-sixteenths cent premium.

Zinc Quiet at 6⅛c.

There is little to say about the zinc market. Prices have been advanced gradually to 6⅛c., St. Louis, with 6.15c. realized on certain small lots. Galvanizers have shown little interest, but their lackadaisical attitude is well matched by that of the zinc producers, who would rather add to their stocks than sell freely at the current relative prices of ore and metal. Sales, therefore, have been well below normal.

Spot Tin Somewhat Lower

The local tin situation is virtually unchanged from that described in last week's *Engineering and Mining Journal*, but at slightly lower price levels. Spot metal in New York continues at a premium of close to 1c. per pound over future metal, as the result of the condition arising from a concentration of spot metal in the hands of one interest. Sharp fluctuations in price have occurred during the week, but there is little change in the general situation.

London reports a net decline of £1 2s. 6d. for spot metal since the closing quotation last week. This decline brings London spot tin below the £230 level for the first time since April, 1925.

Foreign Exchange

Closing cable quotations on Tuesday, May 22, were as follows: Francs, 3.93⅛c.; lire, 5.27c. and marks, 23.93¾c. Canadian dollars were quoted at ⅜ per cent discount.

Sterling exchange on May 11 was $4.87⅛ instead of $4.87¾ as published in some copies of *E. & M. J.* of May 19.

Silver at New High

The silver market advanced sharply during the last week, prices reaching a level which had not been touched since Aug. 4, 1926. Reports from abroad state that Japanese banks have been large buyers, and uncertain conditions in China have been the cause of heavy buying from that quarter. The market closes firm, with limited offerings.

Mexican Dollars (Old Mexican pesos): May 17th, 46½c.; 18th, 47⅛c.; 19th, 47¼c.; 21st and 22d, 48½c.; 23d, 48¾c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, for all positions, 11⅛c.

Cookson's "C" grade, spot, 15⅜c. Needle antimony nominally 7½c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 11¼c.

BISMUTH—Per lb., New York, in ton lots, $2.10. Smaller lots, $2.25 and up.

CADMIUM—Per lb., New York: 65c. Spot metal, 75c. Excellent demand.

IRIDIUM—Per oz., $275@$300 for 98@99 per cent sponge and powder. Market dull, prices largely nominal.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. Absolutely no activity in market.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75.50@$76.50 asked. Market very quiet.

QUICKSILVER — Per 76-lb. flask, $123@$125, depending on quantity. San Francisco wires $119.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of May 5.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the May 5 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $11.00@$11.05. Shortage of Chinese ore foreseen as the result of warlike conditions in the Far East. Western scheelite, $10.75.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the May 5 issue.

Sellers Attracted by $40 Zinc Ore

Joplin, Mo., May 19, 1928

Blende

	Per Ton
High	$41.50
Premium blende, basis 60 per cent zinc	$40.00@41.00
Prime western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent basis	36.00@39.00
Average settling price, all zinc	37.99

Galena

High	$78.70
Basis 80 per cent lead	77.50
Average settling price, all lead	76.23

Shipment for the week: Blende, 11,705; lead, 1,569 tons. Value, all ores the week, 564,280.

Buyers found an easy market on a $40 basis for Prime western grades and purchased 17,750 tons by mid-afternoon today. This should lower the reserve stock of Jan. 1 about one-third. Other reserves are in strong hands and held for a further advancing market. Reports of sales of a portion of the reserve lead ore stocks are afloat, and may develop into an increased shipment next week. Holders are generally asking $80.

Platteville, Wis., May 19, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$41.75
Lead Ore	
Lead, basis 80 per cent lead	$78.50

Shipments for the week: Blende, 656 tons; lead, none. Shipments for the year: Blende, 14,663 tons; lead, 840 tons. Shipments for the week to separating plants, 854 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the May 5 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market quiet.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the May 5 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for second quarter, 1928. Spiegeleisen, 19@21 per cent, $32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 95@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the May 5 issue.

Metal Products

ROLLED COPPER — Sheets advanced from 23 to 23¼c. per lb. May 17; wire advanced from 16⅛ to 16½c. per lb., May 23.

NICKEL SILVER—Per lb., 18 per cent nickel Grade A sheets, price advanced from 29¼ to 29½c., May 15.

YELLOW (MUNTZ) METAL—Dimension sheets, 20c. from 19¾c. per lb.; rods, 17c. from 16¾c. per lb., May 15.

Lead Sheets, and Zinc Sheets are unchanged from prices in the May 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of May 5.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17.50; basic, $16.25@$16.50; No. 2 foundry, $17.00@$17.25.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.60@$2.75. Connellsville foundry, contract, $3.75@$4.25; spot, $3.50@$4.25. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended May 19, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	74⅜	68⅜	69¼	Ap.14, My.21 Q	0.75
Ariz. Com'l	Boston	5⅛	4⅛	4⅛	Ja. 19, Ja. 31 SA	0.25
Cal. & Ariz	New York	109⅛	101½	104½	Ma. 3, Ma. 19 Q	1.50
Calumet & Hecla	Boston	25	23½	23½	Fe. 28, Ma. 15 Q	0.50
Cerro de Pasco	New York	72	68	69½	Ap.12, My.1 Q	1.00
Chile Copper	New York	44⅜	42½	42½	Jn.6, Jn.30 Q	0.62½
Con. Coppermines	N. Y. Curb	14⅛	13⅛	13⅛		
Copper Range	Boston	23	19⅜	20⅛	Ma. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	1 3/16	*97	1 1/16		
East Butte	Boston	3⅜	2⅜	2⅜	Dec., 1919	0.50
Granby Consol	New York	56⅜	53⅛	54⅛	Ap.13, My.1 Q	1.00
Greene Cananea	New York	133⅛	118⅛	121⅛	Nov., 1920	0.50
Howe Sound	New York	61⅞	57⅜	59⅞	Ma.31, Ap.16, Q	1.00
Inspiration Consol	New York	23⅛	22⅛	22⅜	Apr. 1927 Q	0.25
Isle Royale	Boston	24⅜	18⅜	20	Fe.28, Ma.15 SA	0.50
Kennecott	New York	93⅜	88⅛	90⅞	Ma. 2, Ap. 2 Q	1.25
Magma Copper	New York	55⅛	49⅜	54	Ma.31, Ap.16 Q	0.75
Mason Valley	New York	1⅛	1⅛	1⅛		
Miami Copper	New York	21⅛	19⅜	20⅛	My.1, My.15, Q	0.37½
Mohawk	Boston	59⅛	56⅛	56⅜	Ap. 30, Jn. 1 Q	1.00
Montana-Idaho	Spokane	*31⅛	*30	*30		
Mother Lode Coal	New York	4⅛	3⅛	3⅜	De.16, De.31 SA	0.25
Nevada Consol	New York	25⅜	23⅜	24⅛	Ma.16, Ma.31 Q	0.375
New Cornelia	Boston	29⅜	28⅜	29¼	My. 4, My. 21 Q	0.50
Noranda	N. Y. Curb	24⅞	20⅛	23⅛		
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*85	*80	*80	Sept., 1926	0.03
Old Dominion	Boston	15⅛	13⅛	14	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	135¼	132	134⅜	Ma.20, Ap.2 Q	1.50
Quincy	Boston	42	35	39⅜	March, 1920	1.00
St. Mary's Min. Ld	Boston	34⅛	30	30⅛	Ap.1928 A	2.00
Seneca Copper	New York	3⅛	2⅛	3		
Shattuck-Denn	N. Y. Curb	23⅛	19⅜	21		
Tenn. C. & C	New York	14⅛	13⅜	14	Ma.29, Ju.15,Q	0.12½
United Verde Ex	N. Y. Curb	22⅛	21½	22	Ap.6, My.1, Q	0.50
Utah Copper	New York	160	151	160	Ma.16, Ma.31 Q	1.50
Utah Metal & T	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*93	*88	*93		
NICKEL-COPPER						
Internat. Nickel	New York	95⅛	88⅛	91¼	Ma.15, Ma.31Q	0.50
Internat. Nickel pfd	New York	...	...	115	Ap.12, My.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*7⅛	*6⅜	*6⅜	June, 1927	0.005
National Lead	New York	129⅛	126	126⅛	Jn.15, Jn.30 Q	1.25
National Lead, pfd. A	New York	147⅛	147	147⅛	Ju.1, Ju.15 Q	1.75
National Lead, pfd. B	New York	120⅛	120⅛	120⅛	Jy. 20, Au. 1 Q	1.50
St. Joseph Lead	New York	49	39⅛	45⅛	Jn.9, Jn.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	32⅜	24⅛	27⅞	May, 1917	1.00
Am. Z. L. & S. pfd	New York	95	86⅛	87⅛	Nov., 1920	1.50
Butte C. & Z	New York	7	5⅜	6⅜	De., 1926	0.50
Butte & Superior	New York	15	10⅜	14⅞	Ma.14, Ma.31 Q	0.50
Callahan Zn-Ld	New York	4⅜	3⅜	4	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	17⅛	14⅛	15⅛	Ap., 1927	0.25
Eagle-Picher	Cincinnati	17⅜	16⅛	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	102⅛	102⅛	102⅛	Ma. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	221	219⅜	220	Ap. 20, My. 10 Q	2.00
Treadwell-Yukon	Toronto	20	19⅛	19⅛		
United Zinc	N. Y. Curb	*70	*55	*70		
Yellow Pine	Los Angeles	*32½	*32	*32	Dec., 1925 Q	0.04
GOLD						
Alaska Juneau	New York	4⅛	3⅞	3⅞		
Ankerite	Toronto	*30	*30	*30		
Barry-Hollinger	Toronto	*93	*80	*90		
Central Manitoba	Toronto	1.33	1.25	1.33		
Cresson Consol. G	N. Y. Curb	1⅛	1⅛	1⅛	Ma.31, Ap.10 Q	0.10
Dome Mines	New York	10	9¼	9⅛	Ma.31, Ap.20 Q	0.25
Golden Cycle	Colo.Springs	†1.76	†1.74		Fe.29, Ma.10 Q	0.04
Gold Hill	Toronto	*15	*11½	*13		
Hollinger Consol	Toronto	16.00	15 60	15 75	My.2, My.19 FW	0.10
Homestake Mining	New York	73	72	73	My.10, My.25 M	0.50
Kirkland Lake	Toronto	1.85	1.77	1.77		
Lake Shore	Toronto	23.75	22.75	23.55	Jn 1, Jn.15	0.20
McIntyre Porcupine	New York			26¼	May1, Ju.1 Q	0.25
Portland	Colo.Springs	†*20	†*19		Ap., 1927	0.02
Rand Mines	New York	43	43	43	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	3.20	3.15	3.21		
Teck-Hughes	Toronto	10.30	9.20	10.25	Ja. 17, Fe. 1 X	0.15
Tom Reed	Los Angeles	*43	*45	*45	Dec., 1926	0.02
Tough-Oakes	Toronto	*33½	*21	*26		
Vipond Cons	Toronto	*63	*61	*60	April, 1927	0.03
Wright-Hargreaves	Toronto	4.60	4.40	4.55	Ap.13, My.1 Q	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	24⅛	22⅛	23⅛		
Con. Cortez	N. Y. Curb	*33	*29	*29		
Dolores Esperanza	N. Y. Curb	1⅛	1	1	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	16⅛	16⅛	16⅛	Ap.18, Ap.28 Q	0.50
Premier Gold	N. Y. Curb	2 1/16	2⅛	2⅛	Ma.15, Ap.4	0.08
Tonopah Belmont	N. Y. Curb	1 1/16	1	1 1/16	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*16	*14	*16	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4	4	4	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb	*6	*4	*6	Mar., 1923	0.05
Yukon Gold	Boston Curb	*74	*62	*62	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.36	1.31	1.36	May, 1920	0.03
Castle-Trethewey	Toronto	*65	*60½	*64½		
Coniagas	Toronto	5.15	5.00	5.02	May, 1924	0.12½
Keeley	Toronto	*64	*60	*64	Ma.1, Ma.15 SA	0.04
Lorrain Trout Lake	Toronto			*30	July, 1925	0.05
Mining Corp. Can	Toronto	3.45	3.30	3.35	My.20, Jn.13 SA	0.125
Nipissing	N. Y. Curb	4⅛	4⅛	4⅛	Ma.31, Ap.20Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	5⅛	4⅛	4⅛	Ap., 1927	0.12½
Bingham Mines	Boston	53¼	51	52⅛	Ma.22, Ap.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	...	...	137	Ap.30, My.4 MX	0.75
Cardiff M. & M	Salt Lake	*75	*72	*75	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.25	4.20	4.20	Ja.10, Fe.1 Q	0.10
Consti'n Mng.&Mill'g	Spokane	*15	*10	*10		
Erupcion	Boston Curb	*30	*30	*30	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.05	2.02½	2.02½		
Federal M. & S	New York	145	130	130	Je., 1927	10.00
Federal M. & S. pfd	New York	98	97	98	My.25, Jn.15 Q	1.75
Hecla Mining	N. Y. Curb	16	14⅛	15	My.15, Jn.15 Q	0.15
Highland-Surprise	Spokane	*14	*12	*13		
Iron King Mining	Salt Lake	*73	*68	*68		
Keystone Mining	Salt Lake	†*.32	†*.28	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*34½	*34	*34		
Lucky Tiger-Com	Kansas City	†7.95	†7.75	...	My.10, My.19 MX	0.07
Mammoth Mining	Salt Lake	†1.75	†1.50		De., 1926	0.25
North Lily	Salt Lake	8.50	7.50	7.50		
Park Utah	New York	14⅛	12⅜	13	Ma.15, Ap.15 Q	0.20
Plutus Mining	Salt Lake	2.00	2.00	2.00	Ap.10, Ap. 16 Q	0.10
Silver King Coal	Salt Lake	12.50	11.87½	12.37½	Ma.20, Ap.2 Q	0.25
Silversmith	Spokane	*20½	*19½	*20½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*62	*50	*56		
Sunshine M. Co	Spokane	1.54	1.45	1.48	Fe.10, Fe.20	0.10
Tamarack-Custer	Spokane	*84	*75	*78	Sept., 1924	0.25
Tintic Standard	Salt Lake	14	13⅜	13⅜	Ma.21, Ma.29Q	0.30
Utah-Apex	Boston	4⅜	4⅛	4⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	65⅞	61⅛	62⅛	Jy., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	120	115	117	Ap.13, Ap. 25 Q	1.00
Colorado Fuel & Iron	New York	75⅛	71	72⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	23	22	22⅛	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	59	55⅜	58	My. 15, Jn.1 Q	0.62½
Republic I. & S	New York	62	58⅜	58⅛	My. 15, Jn.1 Q	1.00
Republic I. & S. pfd	New York	107⅜	107	107⅛	Jn. 15, Jy. 2 Q	1.75
Sloss-Sheffield S. & I	New York	119	116	116	Ma.10, Ma.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	...	...	122½	Ma. 20, Ap. 2 Q	1.75
U. S. Steel	New York	149⅛	143⅛	145⅜	My.31, Jn.29 Q	1.75
U. S. Steel, pfd	New York	145	144⅛	144⅛	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C	New York	...	...	31⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	...	...	57	De. 16, Ja. 3 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	28⅛	27	27	Jy., 1927	1.45
So. Am. G. & P. New	N. Y. Curb	3⅜	3⅛	3⅜		
Alum. Co. of Amer	N. Y. Curb	197⅜	170	170		
Alum. Co. of Amer. pf	N. Y. Curb	110	109⅜	109⅜	Ma. 15, Ap. 1 Q	1.50
Vanadium Corp	New York	88⅞	82⅛	83⅛	My. 1, My. 15 Q	0.75
Patino M. & E	New York	40⅞	36	36⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	37⅝	35	35⅛	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	95⅛	94⅞	95	Ma. 31, Ap. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	74⅞	69⅛	70⅛	Ap.14, Ma.1 QX	1.75
Texas Gulf	New York	72⅛	69⅛	71	Ju.1, Ju.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48⅛	45	47	My.15, Jn.1	0.75
Amer. Metal, pfd. 6%	New York	117⅛	116	116	My.15, Jn.1	1.50
Amer. Met. pfd. 7%	New York	125	125	125	My.15, Jn.1	1.75
Amer. Sm. & Ref	New York	200⅛	189⅜	192⅛	Ap.13, My.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	140	139	139	My. 4, Jn. 1 Q	1.75
Consol. M. & S	Montreal	279	272	272	De. 31, Ja. 16 X	6.25
Newmont Mining	N. Y. Curb	183⅛	171	173⅛	Ma.31, Ap.16 Q	1.00
U. S. Sm. R. & M	New York	49⅞	45⅛	48⅛	Ap.5, Ap.14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54⅛	53⅛	54	Ap.5, Ap.14 Q	0.87½

*Cents per share †Bid or asked Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED May 8, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	4/—	3/9	4/—			
Alaska Treadwell ($25)	147/6	132/6	145/—	Nov., 1926	4 ($)	
Aramayo Mines (25 frs.)	77/6	71/1½	72/6	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/—	13/4½	13/7½	Jan., 1928	6 annas*	
Bwana M'kubwa (5s)	4/10½	4/7½	4/10½			
Camp Bird (2s)	4/9	4/3	4/7½	April, 1928	16¾ p.c.	
El Oro (£1)	4/9	4/4½	4/6	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	14/6	13/9	13/9	Jan., 1928	5 p.c.	
Mexican Corpn.(£1)	11/7½	10/6	11/3			
Mexico Mines of El Oro (£1)	60/—	37/6	45/—	Dec., 1926	3¾ p.c.*	
Mond Nickel	192 6	175 —	186/3	Feb., 1928	7½ p.c.	
N'Changa Copper Mining	10/—	9/6	10/—			
Oroville Dredging (£1)	4/—	3/9	4/—	Dec., 1923	3½ p.c.	
Rhodesian Congo Border (£1)	20/7½	19/3	20/—			
St. John del Rey (£1)	11/9	10/10½	11/3	April, 1928	7½ p.c.	
San Francisco Mines (10s)	32 6	30/1½	30/9	Jan., 1928	25s.	
Santa Gertrudis (£1)	16/3	15/6	15/6	Jan., 1928	7½ p.c.	
Selukwe (2s. 6d.)	13/3	10/7½	12/6	April, 1917	6¼ p.c.	
S. Amer. Copper (2s.)	3/3	2/10½	2/11½	Nov., 1917	75 p.c.	
Tanganyika (£1)	72/9	63/9	68/1½	Aug., 1927	7½ p.c.	
Union Miniere de Haut-Katanga (Brussels)	8,312.50	7,970	8,250	July, 1927	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.

Current Prices of Mining Supplies

Rise and Fall of the Market

CAST-IRON pipe advanced $1 per ton during May, following a similar rise last month. Railroad spikes are up about 5c. per 100 lb. at mills, while most of the other steel products on the list lack firmness. Galvanized steel sheets declined 5 to 10c. and wire nails, 10c. per 100 lb. at Pittsburgh mills, during the month. Raw linseed oil shows a net increase of 0.3c. per lb. at Minneapolis, compared with the April quotation. Prices of heavy mine timbers are approximately 8 per cent below levels of a year ago.

SHEETS—Quotations are per 100 lb. in various cities delivered from warehouse, also the base price at mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.60@$3.65	$5.25	$4.80	$5.50	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham in carloads:

	Pittsburgh	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00
Standard open hearth rails	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for large mill lots, together with the warehouse prices at other places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	3.40	4.25	4.25	....

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in large mill lots, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations are per 100 lb., delivered from warehouse:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$2.05	$3.30*	$5.00	$3.25	$3.10	$3.25
Channel, 3 to 15 in.	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Angles, 3 to 6 in., ¼-in. thick	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Tees, 3 in. and larger	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Plates ¼-in. thick	1.85	2.05	3.30*	5.00	3.25	3.10	3.25

*250 to 3,999 lb.

WIRE ROPE—Discounts from list price, f.o.b. New York and territory east of Missouri River on regular grades of bright and galvanized, are as follows:

Cast steel round strand rope	20 %
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5 %
Plow steel round strand rope	35 %
Special steel round strand rope	30 %
Gavanized iron rigging and guy rope (add to list)	12½%

MANILA ROPE—Per lb., ¾-in. and larger, delivered in 1,200-ft. coils:

Atlanta	$0.25	New Orleans	$0.23½
New York	.24	Seattle	.21½
Chicago	.21	San Francisco	.23½

DRILL ROD (from list at warehouse)

New York	Cleveland	Chicago
60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are for large mill lots at Pittsburgh mill:

	Steel			Iron		
	Inches	Black	Galv.	Inches	Black	Galv.
Butt Weld	1 to 3	62	50½	1 to 1½	30	13
Lap Weld	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in., lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices on bell and spigot pipe, Class B and heavier, f.o.b. per net ton, for large mill lots.

	Birmingham	New York	Chicago	St. Louis	San Francisco
6 in. and over	$29.00	$38.60	$38.20	$34.60	$40.00

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full packages, discount 50% from latest list, April 1, 1927, at warehouses in New York and vicinity

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, carry a discount of 55% from latest list, April 1, 1927, on immediate deliveries from warehouse stocks in New York and vicinity.

HOLLOW TILE—Price per block to contractors, in lots of 2000 pieces or over:

	New-York	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.1004	$0.076	$0.11	$0.078	0.108	
6x12x12	.1506	.104	.....	.105	.156	$0.252*
8x12x12	.1883	.142	.22	.145	.255	.312†

*10x12x12; †12x12x12.

LUMBER—Prices are per thousand feet, board measure:

San Francisco—Rough Douglas fir, No. 1 common, delivered:

	10-16-18 and 20 Ft.	22 an 24 Ft
3x3 and 4	$28.00	$29.00
3x6 and 8	28.00	29.00
3x10-6 and 12	28.00	29.00

New York—Prices are for long-leaf, yellow pine timbers (rough) at wholesale, in quantities of 35,000 ft. or more, within lighterage limits:

	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$41.00@43.00	$42.00@44.00
3x10 to 10x10	48.00@50.00	49.00@51.00
3x12 to 12x12	55.00@57.00	56.00@58.00

Chicago—Prices in carloads, f.o.b., for long-leaf, yellow pine timbers, No. 1 and Douglas fir, No. 1:

	Up to 20 Ft., Pine	Up to 32 Ft., Fir
3x4 to 8x8	$37.50	$39.00
3x10 to 10x10	45.00	39.00
3x12 to 12x12	55.00	39.00

Other Cities—Price for rough timbers delivered:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$47.50	$47.00	$47.50	$50.00	$56.00	$54.50
Cincinnati	33.00	46.00	44.00	44.00	37.00	50.00
Denver	.....	31.75	.....	.....	.....	32.75
Minneapolis	50.00	45.25	36.25	.....	52.00	46.75
Kansas City, Mo.	40.75	38.75	.....	.....	53.75	38.75
Philadelphia	54@55	37@38	44@45	45@46	62@63	37@38

* Douglas Fir.

NAILS—The following quotations are per 100 lb. keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.55@$2.65	$3.10	$3.60	$4.00	$2.83½	$4.95
Cut	2.80	.....	5.00	5.00	.....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags.* Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@$2.35	$2.25@$2.35	$2.35@$2.50
Chicago, f.o.b.	2.05	2.05	2.05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Delivered: New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$21.00@22.00	$14.00@15.00	$4.00@4.10	$3.15@ 3.25
Chicago	20.00	18.00	.....	1.50

LINSEED OIL—These prices are per pound:

	New York	Chicago	Minneapolis
Raw in barrels (1 to 4 bbl. lots)	$0.111	$0.104	$0.116

WHITE AND RED LEAD—Per 100-lb. keg base price, f.o.b. New York.

	Dry	In Oi
Red	$13.25	$14.75
White	13.25	13.25

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) $0.68 per ft.

Air—Best Grade
¾-in., per ft. 3 ply $0.36½ 4 ply $0.44

Steam—Discounts from List
First grade 30-10% Second grade 40% Third grade 45%

RUBBER BELTING—List price 6-in., 6 ply. $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:
Best grade 45% Second grade 50%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply, at New York warehouses:

Grade	Discount from list
Medium	35%
Heavy	30%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.55
Rubber sheet wire insertion	.75

EXPLOSIVES—Prices per pound for dynamite delivered in small lots:

	Gelatin 40%	Gelatin 60%
New York (special gelatin in case lots)	$0.26	$0.2825
Minneapolis	.2017	.2223
Denver (f.o.b.)	.1975	.22
Seattle	.16	.185
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.09@.10
Litharge, casks	.08½
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.0